Australian Innovation in Cargo containerisation

Innovation that led the world

Published by: JW Shannon Engineers

First Edition: July 2016

Author: JW Shannon

Title: Australian Innovation in Cargo Containerisation

ISBN: 978-0-646-95930-6

ISBN 978-0-646-95930-6

9 780646 959306 >

Dewey Number: 387.5442

Notes: Includes bibliographical references and index.

Subjects: International Organization for standardization.
J W Shannon Engineers (Firm)
Containerization--Technological innovations--Australia.
Containerization--Standards--Australia.
Freight and freightage--Technological
innovations--Australia.

Other Creators/Contributors:
J W Shannon Engineers (Firm), issuing body.

Preface

In less than one lifetime we have progressed from the consolidation of goods packed for transport into an infinite variety of containers to the overwhelming preference for two sizes of internationally accepted boxes one 20 ft long x 8 ft wide and the other 40 ft long and the same width. This has changed living standards for the better in much of the world at the expense of first world manufacturing workers and to the benefit of third world workers.

Australians played a leading role inventing and demonstrating the means by which this occurred and this history is written to record their deeds and honour some of the key people who made it happen.

In the background there are gigantic and largely unregulated struggles between the demands of workers for living standards they desire and competition between transport companies to transfer goods profitably so they can reward their investors. These struggles and a rising world population have resulted in large numbers of unemployed and many more underemployed workers.

We are already well into another development, automation. This will eliminate many more work occupations and change the character of the rest. The development of containerisation is limited to transport, this change to automation will be universal and so far there is no sign, to this author, that the organisers and manipulators of populations have any clear appreciation of what to do.

It is hoped that this history and the examples of what has happened to transport can be useful in guiding the future and interesting to our descendants.

Jim Shannon

July 2016

Contents

Introduction

The sight of cargo containers around wharfs and stores, on trucks and rail wagons is so familiar we hardly notice them. Nevertheless by reducing the cost of transport they have been one of the more important factors that improve our living standards. The containers we see are built to international standards and can be found in virtually every country of the world.

Of course it did not start this way. It was made possible by the pioneering efforts of far sighted special people in just two countries. One was Australia.

This book is written to tell of the Australian developments by recording our successes and honouring some of the leaders who saw the possibilities, took the risks and set the pace.

Background

World War 2 had taken many of our Australian men and women, curtailed building infrastructure and produced shortages of manufactured and primary products and there was a hunger for something better. In the 1950's we were working to overcome this legacy. It was an exciting time. Politically we were stable, high import duties protected local manufacturing workers and we were absorbing record numbers of migrants from both Britain and other war torn countries. Incomes were rising, expectations were high.

Our towns and population centres are mainly close to the coast and separated by great distances making the transport of people and cargo between them time consuming and costly. The construction of new roads and rail services had almost ceased during the war years and the need for both overseas and coastal shipping was paramount. Perversely this was

troubled by cargo shipments in one direction only and militant waterside and seafarer unions that made coastal shipping services uneconomic.

All forms of transportation are costly liabilities when stationary and earn income only when performing their transfer function. That is transferring people and cargo from one place to another. The more costly the transport equipment, the greater is the liability and cost when stationary. The only practical economy is to keep aircraft purposefully in the air and ships at sea. In those years air travel was still a long way from its prominence now and the need for shipping overwhelming.

Our break bulk coastal ships were spending an average of 45% of their time in port and more if there was industrial disruption.

The Australian coastal shipping company McIlwraith McEacharn had an inspiring CEO, JHH (Jack) Paterson who was called Chief Manager to distinguish him from a state manager. In turn he had the confidence of his board under the chairmanship of Ian (later Sir Ian) Potter.

Jack and the board knew they had to reverse the losses caused by cargo handling or get out of Australian coastal break bulk cargo transport. Overseas cargo would continue to arrive because there was no alternative, but coastal shipments between mainland ports had no future without a reduction in costs.

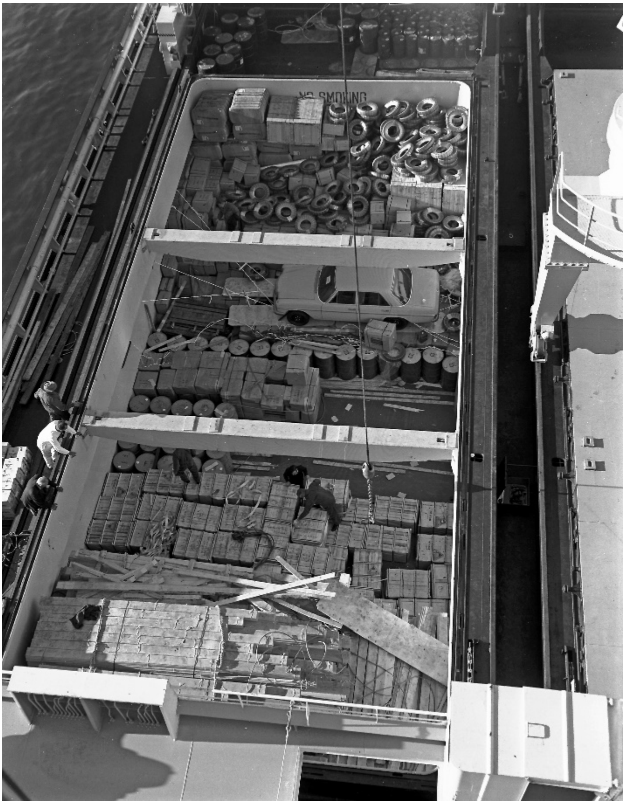

Image 1: This image illustrates break bulk, which means miscellaneous dry cargo in the hold of the vessel Atrevida in Fremantle harbour in May 1968. Each piece was man-handled individually into a rope net sling or to a crane hook to get it on or off the ship.

The motor vehicle tyres may be cargo or dunnage the miscellaneous planks are dunnage, and were used as spacing between items and for wedging the cargo in place. The multiple ropes used to secure the car can be seen. Even so cargo movement and damage at sea was common.

Some of the workers and supervisors can be seen. An average of about 1 tonne of cargo per worker was achieved.

Images 2&3: Atrevida Fremantle harbour May 1968. *Workers lashing break bulk cargo*

In the 1950's DJG (Don) Strang who controlled a prominent cargo organising and handling business in Victoria was also a member of a British group, the International Cargo Handling Co-ordinating Association (ICHCA). This is a non-political, voluntary organisation dedicated to improving cargo handling performance. Naturally the members were mostly seaman and transport executives. Strang organised a group branch in Australia in the early years of the 1950's that had an initial membership of nine including Jack Paterson. In 1956 his special development assistant AC (Adrian) Boehme joined. It was clear that ships had to be worked more productively and that a way to do this was to consolidate cargo into standard unit loads prior to the arrival of a ship and then handle it as series of single units when working the ship.

Jack Paterson was a very early leader determined to make cargo transport by sea competitive with road and rail, reliable to its clients and profitable to its investors.

JHH Paterson MBE 1917-1991

John Hugo Heddle (Jack) Paterson joined the Australian coastal shipping company McIlwraith McEacharn in 1935 as an 18 year old and except for time in the navy during WW2 he worked with them and their successors all his life. He had joined the Australian Navy Reserve before the war and enrolled in the Australian navy to serve from 1939 to 1946 before being demobbed with the rank of Lieutenant Commander.

During the war one of his postings was as a coastal watcher in Japanese held PNG. Here equipped with little more than an HF radio he hid in the jungle helped by PNG Nationals and radioed out observations of Japanese shipping and army movements, information of vital importance to Australian and American commanders. Lacking further details all we can say is that he was engaged in perilous work and would have been killed on the spot along with his PNG helpers and their families if found by the Japanese. He was awarded an MBE and it seems likely that this recognises his coastal watch duties.

By 1956 Jack was married to Sonia and they had two sons Andrew and John and lived in a suburb of Melbourne. We have been told that subsequently Andrew joined the Australian army and was killed in a training accident. John is thought to be alive and successful but so far has not been located.

By the early 1950's, Jack was Victorian manager for the company and had joined the local branch of the International Cargo Handling Co-ordinating Association (ICHCA) formed by Don Strang. In 1956 he became Chief Manager (Australian Manager) of McIlwraith. By then coastal shipping was in crisis. Beset by militant Waterside, Seafaring and Clerical unions the industry was lossmaking. It could only change to a profitable basis or get out of

coastal shipping. Jack had a confidence creating personality and a sympathetic board so it was decided to make the changes needed.

From the late 1950's the pace of change to Australian ship working, ship design and shore mechanisation was relentless. It was driven by both domestic and international events. The development of improved cargo handling machinery and methods was being tutored by the pioneers in USA and Australia. The rest of the world had no choice but to strive to catch up or quit. Most trading countries recognised they numbered with those who had no choice. Suppliers and buyers jostled to keep, reclaim, or extend their markets. Every improvement released a greater volume and tonnage of trade.

It may not have been initially recognised but time honoured paper work manifest systems struggled and often failed to direct the flood. It took many years to develop the hardware and software programs that now run the manifest systems. Before that situations were often chaotic and stressful. Vessels had to be discharged in an order that maintained ship stability, protected perishable and dangerous cargo, satisfy receiving shippers and make outgoing road, rail and feeder vessel movements practical.

Outgoing cargo had to be loaded to suit its destination port order, maintain vessel stability, provide refrigeration where needed and separate hazardous materials from others. All of this was complicated by the uncontrollable effect of road and rail delays and human mistakes. It happened at an ever faster rate and stressed every control and organising function.

Jack Paterson had an acute appreciation of what had to be achieved and bestowed on others the support they needed to survive each day and achieve remarkable results.

The Log. The quarterly Journal of the Nautical Association of Australia. The following Obituary of JHH Paterson provided by TSS Stevens and recorded below in full. It does not include a date.

OBITUARY —J. H. H. PATERSON

We regret to record the death of Mr. John H. H. Paterson, MBE, on 22 December 1991 at the age of 74 years. A former Managing Director of Associated Steamships Pty. Ltd., he was a leader in the cargo handling revolution that came to the Australian coast in the first half of the 1960s, and was particularly involved in the building and introduction of the self-supporting cellular containership Kooringa (5,825/1964) and the associated shore side back up. With the Australian international trades being containerised, ASP and OCAL combined to form Seatainer Terminals, of which Mr. Paterson was the first Chairman. He was a member of many industry committees and served as the second President of the Australian Chamber of Shipping.

Jack Paterson was a shipping man all his life, having joined McIlwraith McEacharn Ltd. in Melbourne in 1935. He served in the RAN from 1939 to 1946, being demobilised as a Lieutenant-Commander. He returned to McIlwraith, being first involved in overseas agency work and then in 1956 he became Manager of the Head Office in Melbourne, which position brought him into closer involvement with the coastal operations which were then in steep decline. By the end of the decade the Associated Steamship Owners arrangement had all but disintegrated and, at the end of 1963, The Adelaide Steamship Co. Ltd. and McIlwraith McEacharn Ltd. combined their coastal cargo interests to form Associated Steamships Pty. Ltd. of which Mr, Paterson was, at first, General Manager.

From the time the Nautical Association was inaugurated Jack Paterson took an interest in its activities and he was a long-time member. Additionally, through his forbearance, the Association was able to use ASP equipment and facilities for many years. He was an active member, and office-bearer, of the Victorian Division of the Navy League of Australia.

(A review of Associated Steamships Pty. Ltd., with which company Mr. Paterson was so intimately involved, appeared in the four issues of The Log in 1984. Editor).

Consolidating cargo for transport into containers is as old as history but it took a long while to grasp the principals of standardisation and making them intermodal. In America Keith Tantlinger led the way, for us in Australia it was Norman Wright.

Norman Wright. OAM

Norman's father was a career soldier with the British army Middlesex Regiment He married in 1909. He was assigned to Singapore and moved there with his wife. Later he was reassigned to India and his son Norman was born in Kanpur, Uttar Pradesh in 1913. In 1915 soon after the start of the world war he was reassigned again this time to Adelaide and seconded to the Australian army to train newly recruited troops. He held the rank of Lieutenant Colonel when he retired and had been awarded an OBE and Military Cross

Norman went to school in Adelaide and after graduating from the Technical High School was employed by the firm, William Adams, becoming head storeman in time. He married Daphne in 1939 and then spent 5 years in the RAAF. On discharge in 1945 he worked for a small engineering factory owned and run by a man called Parks. He was a competent and diligent worker who got on well with his boss and workmates and rose to become senior foreman. In 1947 the owner of the factory Parks, died and as his son had no interest in it, Norman and his wife Daphne bought it from his widow. So in 1947 Norman owned and ran his own factory.

Clearly he was a designer and innovator because over the years he designed and built stump jump plows for local farmers, made giant truck bodies for the mining industry, built garages, fencing and transport containers for a number of clients.

His daughter Meredythe remembers her father making transport containers well before 1962 and believed it was probably for the Australian coastal shipping company the Adelaide Steamship Company. His son Ian recalls his father moved his factory to Dixon Street in 1956 or 57 because he needed the

extra space to make a big order of containers. Another daughter Sue recalls that he won an international order for a large number of international size containers and we know this must have been in the late 1960’s or early 1970’s. One of them also recalled that their dad invented the central door locking mechanism now used universally on closed containers and many truck enclosures.

In the early 1950s coastal shipping was vitally important to Australia as it was reorganising and rebuilding after the end of the Second World War. Some of the ships had been requisitioned for service to the war effort and were suffering the effects of their age and the difficulties caused by the steeply rising costs of crewing and wharf cargo working labour.

Norman believed containerising the cargo for shipping could overcome some of the difficulties and worked with coastal shipping company McIlwraith McEacharn and others to develop suitable containers. These were the D boxes that figure prominently in this book. Author Ron Parsons reports that “transport boxes and wire mesh crates preceded the Wright D boxes and that these latter units were introduced initially in the Melbourne -Sydney trade in 1957 and that they were so well accepted 6000 were in service by 1960”.

The total number needed would have been a tremendous effort by the Wright Company and moves from premises in Woodville to Tapleys Hill Road and then finally Dixon Street serve to confirm the rapid changes to facilities that he needed. He overcame the limited performance of welding machines of the day, inadequate supply of steel and the unhelpful, threatening attitudes of the labour unions.

His workforce did its best to support him because he was generous to those in trouble. His social and gregarious and driven nature and great skill as a communicator helped to offset increasing competition from third world

countries. Sadly in the end it all became too much and Norm sold his business to Clyde Engineering in 1971.

Norm’s daughter Lisbethsusanne Brown has recalled an incident in her early life that highlights the exemplary standards of her parents. It is called “My Dad’s hidden Treasure” and is located near the end of this book.

The D containers that were both unique and critical to Australia’s entry to containerised cargo are illustrated in the following images.

Image 4: This is a view of a D box lifted high by a dockside crane as it was loaded to or discharged from the vessel Koomilya alongside Victoria Quay in Fremantle harbour in 1960

This is a steel box that could be locked when packed and only opened at its final destination making the cargo safe from pilferage. It was strong enough to protect the contents during transport and support up to three similar containers on top. It had gross weight limit of 3 tons so that it could be handled by early forklift trucks and by slings from ships gear or dock cranes and was sized to fit two abreast on a truck or rail wagon. It was rain proof to keep the cargo dry. It was reusable. It was also small enough to be within the needs of many suppliers and their individual clients.

In early 1957 trial shipments of D containers were made on McIlwraith McEacharn passenger/freight passages between Melbourne and Sydney. These were so successful that by 1960 their use had spread to other shipping

lines and there were about 6000 in use in Australian coastal shipping. The economies they achieved included unit single lifting of multiple cargo items, loading directly to and from road transport at a ship's side. There were multiple benefits.

The traditional hatch working waterside worker crew was ten (10) with a productivity of about 1 ton per worker per hour. The D boxes were worked by gangs of four with a productivity of 15 tons per man per hour. Trucks delivered the containers to and from the ship's side directly to clients and to special packing centres remote from the wharfs and waterside pay rates. The cargo was secure so that freight insurance reduced from rates that would cover claims of up to 30% of the value of goods transported to a percentage that could easily be covered within the actual freight cost. Above all, time in port for cargo working was reduced to improve ship productivity.

Image 5: A D box in the McIlwraith Sudholtze street terminal. The worker is locating the shipping documents. This is an activity now replaced by electronically stored and transferred digital computer records. Two of the lifting rings can be seen at the near end of the box at the top and at the bottom the timber support gluts provide space for fork truck tynes to enter.

Measurement	Internal	External
Length	5’ 08”	6’ 00”
Width	3’ 11”	4’ 02”
Height	5’ 04”	6’ 00”
Gross Weight	3 tons	
Cargo Capacity	2 tons, 12 cwt	

Innovation continued. Fork lift trucks, both battery powered and motorised with exhaust fumes delivered out of the holds in hoses, were introduced to further improve handing productivity and worker safety. Coastal ships once again had a future. There were still problems. The existing hatches were floored by timber of variable strength and condition so that often the fork

trucks threatened, and sometimes did, break through. The drivers developed skill in navigating their way around the weaknesses. Despite these hazards the fork lift handling produced significant cost savings.

Australia was ready for the next leap in technology and one company and its employees was ready and able to provide that leap. The Hoskins family left a great legacy in Australia and a part of this was important to Australia's contribution to container handing in Australia and in setting an example for the world.

Vickers Hoskins

Today we know that aboriginals were here long before white immigrants and that they lived a hunter gatherer lifestyle that was nomadic to match the seasons and thinly dispersed to match the food providing capacity of native plants and animals. In the late 1800's to Australia's mainly English migrants it was a vast almost uninhabited land, where everything was yet to be done. We sometimes dwell on the convicts forced here to relieve English gaols or prisons and fail to notice that there was an underlying and almost unbelievably innovative energy and enterprise that came with them and also our self-funded migrants that drove our progress at breathtaking speed and to amazing feats.

Background

In 1853 an English gunsmith John Hoskins migrated to NSW with his family. When their son Charles left school he tried his luck as a mail boy in the mining community of Bendigo and from there joined a local ironmongery supplier to the mines and community. In 1876 he joined his brother George in a small general engineering workshop in Sydney.

In 1898 they shared with James Mephan Ferguson a contract to manufacture 30 inch bar lock steel pipe for the 563 km goldfields water supply pipeline designed by C.Y O'Connor. They set up a workshop near the railway line in the Perth suburb of Midland Junction to do this.

The WA Goldfields water pipe

Tenders for the pipeline included one from an established manufacturer James Mephan Ferguson in Victoria who offered pipes of steel joined longitudinally by his own virtually untried patented barlock system and another equivalent steel pipe jointed longitudinally by riveting offered by the

Hoskins Brothers of NSW this being a proven method. A third offer was for timber lathe pipes built like barrels and wound around externally and tightly by a thick steel wire to hold them together. There were undoubtedly others.

Charles Yelverton O'Connor the engineer, who had designed the whole scheme for the WA government, preferred the barlock design because it reduced the risk of leakage and reduced the resistance to the flow of the water. He was a farsighted man and confident in his own judgement. This was a massive project for its time and so the two steel pipe makers agreed to cooperate, with Ferguson supplying the pipe making machinery and Hoskins performing the barlock manufacture at Midland. This factory is the origin of the Hoskins works in WA.

Image 6: Bar lock system

On the completion of pipe contract In the latter part of 1902 or early 1903 the Hoskins works moved into Perth city where it occupied a 4 acre site between Murray street and Wellington Street at the western end and built a foundry and general engineering works. This site was also occupied by a company called Western Machinery Company that was supplying and funding machinery purchases for the mines. With an assured water supply, Kalgoorlie, Coolgardie and all of the miles between flourished. New mines were established from Wiluna in the north and to the south, west and east, prospectors were everywhere so Western Machinery was doing very well.

The Hoskins main interest was still in Lithgow NSW and when Charles retired his second son Cecil took over his interests and became Managing Director in 1912. Charles had started to develop works at Port Kembla and in 1924

purchased a 400 acre site. In 1925 Cecil and his brother Arthur took over the development and in 1928 floated a new company The Australian Iron and Steel Limited, to finance development of an integrated Iron and steel works. To the staff there they were known as Mister Cecil and Mister Arthur.

Returning to Western Australia. In 1897 an English born Spanish heritage Basque, 21 year old Claude Albo De Bernales migrated, attracted by opportunities the mines seemed to offer and started with employment to manage Western Machinery. He was an exceptional business man and exceptionally successful. In 1911 he was appointed a director of Kalgoorlie Foundry Limited a mine servicing engineering enterprise and in 1912 of Hoskins and Co.

No records have as yet been found for Hoskins between 1912 and the end of the Second World War. It is sufficient to speculate that both world wars would have placed big demands on every manufacturing facility in the country and that gold mining could have helped to maintain a degree of balance during the depression. It is known that during the second world war Hoskins joined a loose group of engineering contractors organised by Essington Lewis the chairman of BHP, on behalf of the commonwealth government to manufacture selected equipment to aid those most needy.

By now Hoskins owned by descendants of Claude De Bernales was managed by Thomas Hattersley Ineson who had met De Bernales in Kalgoorlie and learned from some of his social attributes. Claude taught him that if you had just sufficient money for breakfast or a new collar you should always buy the collar. In other words that appearance and presence were always important and must be maintained in every circumstance.

Ineson had been alert to every opportunity for advancing the interests of the company and took an informed and long term interest in training apprentices and hiring technically qualified staff.

During the war Hoskins had become a licensee of the Meehanite Metal Company and had a foundry metallurgist to control the quality of the castings. They produced spare pistons and liners for many diesel engines, crankshafts for the Reo buses that worked the war carrying servicemen between the port at Fremantle and Perth, gas producers to power some of the larger factories including Hoskins itself, diesel engines and milling machines.

They also specialised in the design of cranes, mine winders, boilers and slipway winches, one of which had a design rope pull of 190 tons and spent the war slipping American submarines at Fremantle for overhaul between missions. As a consequence they had design engineers and draftsmen, estimators, a comprehensive laboratory and a specialist tool room.

This was the company that employed Jim Shannon part time before graduation, as a trainee Engineer /draftsmen. The Vickers interest in the company commenced in 1956, many years after Jim Shannon started his employment there.

JW Shannon

James William (Jim) Shannon had farming parents so he lived in country Western Australia. His first school was a single teacher country school that taught all levels. He lived only 1 ½ miles (2.4 km) away and so he walked. After only about 2 years his family moved and he then took correspondence lessons followed by a brief time at a different country school and then correspondence again. Not much different to many other country boys and girls.

Again high school was common to other country children too. In his case he went to Northam the nearest centre with a high school. To get there a train journey of about 6 hours was required. The rail siding closest to home had a wheat silo but no station. The train come through about 11 o'clock at night and to stop it for boarding his father stood close to the track and waved a kerosene lantern as a signal to the steam train driver.

Two stops further on his friend Ron Strickland joined the train with his elder sister Shirley. They had farming parents too. Ron became a civil engineer and is the editor of the EA version of the history of The Goldfields Water supply designed by C Y O'Connor. Shirley followed in the footsteps of her father who won the 110 yard sprint called the Stawell Gift and she became a winning and celebrated Olympic hurdles runner. At the Northam high school she was invincible, her tall thin figure leading every race by an ever greater margin.

These were war years so the high school had a mixture of young and much more experienced teachers. Courses then were all pretty much the same except the A classes had higher level maths and science. English and a foreign language were common to all. In his fourth year high school Jim was

offered the chance to sit for a scholarship that would provide financial help during the matriculation year and for a subsequent engineering degree course. Jim did not know what engineering was but he did know that his parents could not keep him at school without help so he took the exam.

Success with the scholarship meant moving to Perth and a longer train journey. By now the war had ended and after matriculation Jim joined the Commonwealth Reconstruction Training Courses set up for the returning servicemen. In retrospect he was very lucky because these were mature people who had been given a chance to finish their education at a level they could not have reached prior to the war. They set an exemplary example.

At Northam Jim was supported by his parents and supplemental income from week end work on an orange orchard plus a 3 day a week rabbit round. For this he set traps in the evening and collected the rabbits next morning before school. A very willing cliental of townsfolk took the dressed carcases. During the long holidays he worked on farms wheat carting with an underage truck drivers licence and for a while as a motor mechanic, untrained. In Perth he was on his own and there were no rabbit warrens to exploit so after a year of scholarship income in straightened circumstances it was obvious he had to get a job. By this time he had an idea about where engineering studies would lead but not many clues about how to use them so he walked the streets of Perth and came upon Hoskins. There he got a job as a draughtsman with time off for lectures and lab work. This was exceptionally generous because he did not know much about drafting either.

In those days a modern engineering office such as Hoskins transferred instructions to the workers via blue prints. Many will have heard the term, few will have seen one. A blue print was indeed blue, the drawing upon it was in white lines figures and notes. Hoskins production of them took place in the print room. Here was housed the print machine, a half cylinder of thick

glass open ended and about a metre radius and 2 metres long. This lay with the top edge horizontal. At the centre of the cylinder an arc lamp ran along a rail pulled by a weight and resisted by a fan. The weight and fan had controls to maintain a sufficient but adequate adjustable speed. The arc was struck between two carbon rods and a self-controlling feed device kept their distance apart constant.

A drawing on tracing (clear) paper was hung over the blue print negative. The two were hung together over the half glass cylinder and with the arc struck the carriage traversed the length of the drawing shining the light through the drawing on to the paper. When the sensitized paper was separated from the tracing paper it was immersed in a flat tank of water that fixed the chemicals and then hung to dry. A blue print was made.

As was common then, the print machine had its habits. It was ever ready to administer a 240 V shock to any careless adjuster of the arc carbons and a hand burn to go with it, plus a blinding flash to anybody who should have looked the other way.

It is now not certain whether subliminal faith in Jim's education or a desire to dampen his ego impelled the decision to ask him to design and draw a lattice girder for an overhead crane as his first task. Fortunately the office had others who could have done this on the back of an envelope and who were kind enough to avert disaster.

A senior engineering lecturer who specialized in structural analysis was a German Jew, Edrich Shilbury. He explained his presence in Australia as due to intolerance of a Mister Hitler. He reported analysis of the Sydney Harbour Bridge with the conclusion that the weight of steel is double what was needed.

He taught much more than structures and stimulated Jim Shannon's interests in graphical methods, including the fitting of empirical data into appropriate geometric and algebraic relationships. However this interest took time to develop

During a very early lecture the geometric function Pi was mentioned and your author volunteered something about 22/7. "Mister Shannon" protested our lecturer standing arms akimbo with deep shock and dismay apparent on his face, "the relationship between the diameter and the circumference of a circle is 3.141593 APPROXIMATELY". He then demonstrated the method by which this can be calculated.

Jack Callow was also a prominent Hoskins design Engineer and his contribution was critical.

John (Jack) Frederick Callow

John's family and most especially his daughters have been diligent in the recording and preservation of his historical background. This has given us a rare opportunity to learn about the characters of some people who helped form our nation. It is especially important to this document because it tells us about John.

John's father George was born into a farming family on a small island called the Isle of Man. This is in the seaway between the United Kingdom and Northern Island at about the level of the English Scottish border. In those days families were large but farmland was limited and so George migrated to Western Australia. In effect it was what we would now call economic migration. He was welcome because he had common language, a common religion and farming knowledge. WA had space and few to do the work. Here he married into a well-established farming family called Minchin and worked in a series of country and suburban locations as a sharefarmer, farm hand, store keeper, and market gardener. His wife Daisy had four girls and John. It seems clear that today we would say they lived in poverty, yet their family photographs show a healthy, immaculately dressed and groomed, bright group of young people.

Image 7: John and his sisters

John's father George was a farmer, skilled in the handling and care of farm animals, in WA they were mostly sheep and horses. By comparison John was interested in machinery and learned by observation the secrets of the stump jump plow which was invented and developed in several forms in Australia. He also learned to drive and maintain early farm tractors and took a job at an early farm stay property because it had a diesel engine driven electric generator that he could maintain and learn about. In common with most young people of his time he left school to work at 15 but even before then had been increasing his education by reading and taking selected correspondence course subjects in his own time.

Because we are today subjected to an endless debate about education and outcomes and costs, John’s schooling is interesting. In his early years kids in towns went to school, there was never more than one teacher per classroom but several grades in each class were common. However in the county, single teacher schools for all classes were the rule except for even more remote students, who studied by correspondence. Once a fortnight the completed lessons were mailed, once a fortnight the marked papers came back. Not yet was the school of the air available. Correspondence students were usually helped and disciplined by their mother. A farm mother was always beset by more than she could possibly achieve, correspondence lessons were just added on top.

John went to school early, aged 5 because he was needed to swell the numbers of the local school to prevent it being closed due to insufficient students. He attended this remote country school for a year took correspondence lessons for most of the second year, then attended a suburban school until 12 and finally completed 2 years at junior high school prior to leaving at 15 to work in the city of Perth as a messenger boy. For his years and in his time John was well educated but he did not stop there, he went to night school studying engineering and commenced a correspondence diploma course in diesel Engineering.

If we can draw any conclusions from this the first would be that a hunger to learn will not be denied. Training levels and scholarly performance have no relevance to the worth of an education but they remain the only way to demonstrate your potential to others. This following last comment is personal to me, the author. If you are lucky enough to learn from an inspiring teacher, take all and every opportunity this privilege provides.

Aged 23 John joined the Australian Air force hoping to make aircrew. His colour blindness denied him this goal and instead he became an aircraftsman

trained to service the aircraft particularly the engines and their special parts. After a posting to Egypt he was seconded to service RAF aircraft in the region. It was during the time of the siege of Tobruk where occupying Australian troops were besieged by the invading German army under Rommel. The aircraft John serviced played an important role by attacking the German troops and their supply lines. Eventually the Germans were forced to retreat.

Here too an accident changed a part of John's life. In preparation for a mission, an armourer was changing the firing detonator on a 500 lb bomb at ground level below an aircraft John was working on. Somehow that armourer made a mistake that detonated the bomb. The aircraft was destroyed and six aircraftsmen nearby were killed outright. John who was moving away to fetch oil, was extraordinarily lucky to escape with a severe wound to his right leg that severed and tore out a section of his sciatic nerve above the knee.

This proved to be a permanent change that left his right leg and foot without feeling and lacking the nerves needed to walk without a calliper on his leg and a special right boot. Part of his remaining air force service was spent at a Wembley personnel staging depot where one of his tasks was to make wooden scale models of wartime aircraft. These were used to demonstrate to trainee airmen the distinct distant appearance of enemy and friendly aircraft.

John was discharged from the air force as unfit for further service and succeeded in an application to attend a 4 year engineering course to professional engineering standards that was introduced as a part of the Commonwealth Reconstruction Training Scheme, (CRTS) for returning ex-servicemen. For John and for many others this was the opportunity of a lifetime. They were now mature people who had had civilian jobs, had

learned from military discipline and survived the exertion and dangers of war. They set an exemplary standard as students.

John graduated as a mechanical engineer in December 1949. By this time he had been married since 1945 and now he and his wife Doris had two daughters. After an initial period in the coal mining town of Collie as a technical teacher he joined engineering firm Hoskins Engineering as a design draftsman and quickly became a Design Engineer. Because he was at a desk the work suited him physically and because he was mature and had practical hands on experience he was almost instantly successful and progressed through a job list of winches and winders and cranes. The work came from the Snowy Mountains Authority the Tasmanian Hydroelectric Authority and BHP and wharves in Fremantle and Geelong.

The work he did was widely varied. The Tumut #1 underground power station in the Snowy Mountains sits at the foot of a vertical water pressure shaft 365 m below the Tumut pond reservoir. The station attracts visitors from Australia and around the world. They do not see the pressure shaft because it is sealed and contains high pressure water from the dam above however they can hear the rush of water and grumbling and rumbling as the turbines start and the whine of the generators. To contain the water the pressure shaft is lined heavily by waterproofed reinforced concrete. John designed the special platform and man hoisting winches that enabled work men to line it.

The recent down turn in the price of steel has brought the Steel works in Whyalla to the news for all the most unfortunate reasons. Those who watch the news have seen and will see again the mighty 150 ton hot metal ladle cranes as they charge and teem the iron to and steel from the blown oxygen converters. Hoskins built these cranes and transported them across the

Nullarbor Plain to the amazement of other traffic. John Callow was the designer in charge of this gargantuan project.

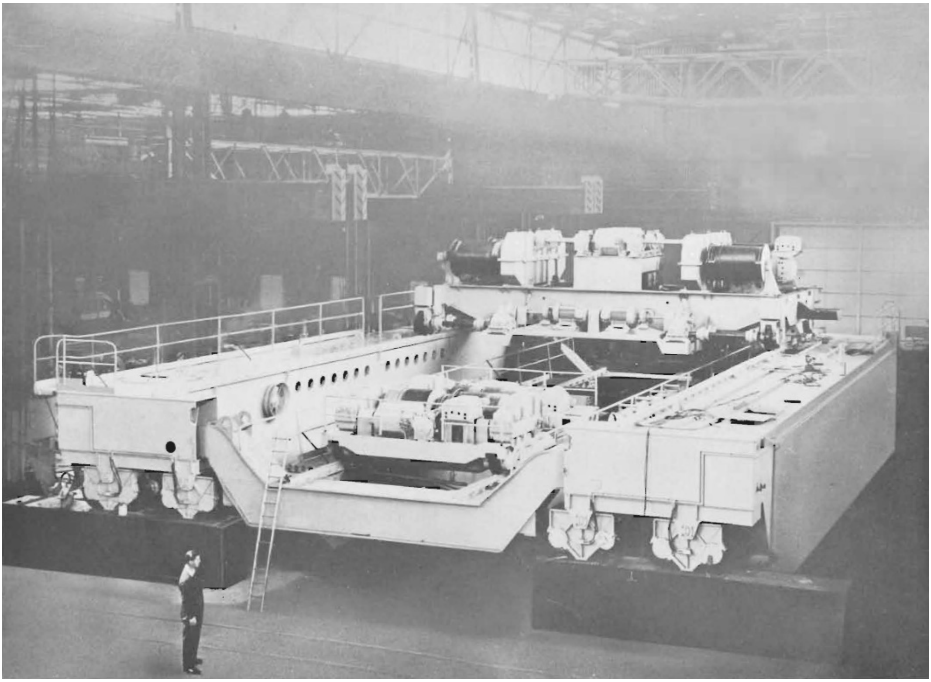

Image 8: 150 ton hot metal ladle crane

Woomera

After the end of the Second World War the world went through the cold war. This was a sorry standoff between the military ambitions of an aggressive Soviet empire and triumphant Western nations. There was dismay and fear, grand standing, fist shaking and brinkmanship and serous efforts to hobble each other by subversion. Nuclear weapons were the weapons of first and last resort.

Initially it was bombs that were the fall-back position. Aircraft carrying nuclear bombs were always in the air but then the German V2 rockets were developed to become the delivery system of choice. It was believed then that nobody can stop a rocket. The US had the German scientists who knew about V2 design but the English had been eavesdropping so they set about designing the Blue Streak. Like the best of the day they had kerosene as fuel and oxidised it by pumping in liquid oxygen as it burned. The next thing they needed was a nice clear range where the flight could be monitored, a launch site, fuel and oxidant. They asked the Australian government for these last four and it agreed to supply them.

A surveyor remarkable in every way, called Len Beadell ran a ruler over an atlas and recommended a path starting just north of Adelaide to a spot on the coast of WA a bit north of Broome as the range. After negotiating a new Land Rover he set off to survey it. At the southern end others tidied up a spot they called Woomera. With a bit of attention to detail, kerosene was no problem but that left the oxygen. 20% of the atmosphere, breath it all the time, use it every day in the cutting torch, too easy. However for a single launch 80 tonnes of the stuff cooled to a liquid, and delivered to the rocket in about 15 minutes was required.

The cooling to liquid is no mystery, we know how to do that but storing 80 tonnes in not just one place, but several of them is another challenge entirely. At atmospheric pressure liquid oxygen boils at -196^{0} C. A drop burns human skin, flesh and bone just as effectively as a drop of liquid steel. As a liquid it looks rather benign, it sits quietly bubbling in a large thermos flask with a cloud of condensed water vapour from the air above it. A piece of fruit, a cast iron ball or a favourite spanner immersed in it can then be dropped to floor to shatter impressively. However if it penetrates clothing, is contaminated by dirt or gains concentration as gas with most common materials, it forms a violently combustible explosive mixture awaiting the tiniest of spark. 80 tons of it is a potential bomb that is capable of the most violent disaster.

The Americans provided storage tank designs, they were giant thermos flasks. That is they had a storage vessel placed inside an outer vessel with the space of one foot between them. The space between them was filled with a natural mica product called pearlite in fine granules and then evacuated to a high vacuum to form the insulation required to keep the sun of Woomera out of the liquid inside.

The inner vessel was 9 feet in diameter and 45 feet long. It was made from AISI grade 347 stainless steel which is a fairly soft 18.8 grade austenitic material. It was only 6 mm thick and to protect against collapse at low pressure it was reinforced internally every 2 feet three inches by a T shaped ring of the same material. The outer vessel was a mild steel and much thicker. It was 11 feet diameter and 50 feet long to allow for some very fancy pipe connections to the inner tank at one end. Six vessels were put out to tender and a further six were to be built in defence material factories in Victoria. Hoskins, now Vickers Hoskins, tendered and after negotiations and post tender evaluation were awarded the job. In retrospect our confidence was wildly misplaced and a review of the first disaster is warranted.

The material for the inner vessel was chosen to be strong at the extreme low temperature. It could not be brittle. That meant the welding of the shell had also to be strong at low temperature. Hoskins had welded stainless steel and was full of confidence. A critical test for the welds was a Charpy impact test at the temperature of liquid nitrogen. Initially Hoskins did not have a Charpy tester and so the defence laboratory's in Victoria offered to do the testing until the Hoskins machine arrived.

For these vessels the Charpy test piece is 10 mm wide and 5 or 10 mm thick and about 55mm long. Each piece was cut and machined accurately from the welded stainless steel plate, etched to find the weld centre, then notched at this place and trimmed to length. Before testing it was immersed in liquid nitrogen until its temperature stabilised, then lifted with tongs to the machine anvil and broken instantly.

A Charpy machine looks like the axe of a medieval executioner. A heavy hammer on an arm is mounted in low friction bearings. It is raised about 120 degrees manually and when tripped it rotates around on the arm bearings pushing a lever before it. The lever has a needle pointing to a disk scale and at the end of the arm travel it stops in place to indicate the end of the swing. A full uninterrupted swing reads zero. A test piece can be placed exactly at the bottom of the swing so that it will be broken as the hammer passes and the energy the hammer requires to do this is measured at the end of the back swing by the distance in degrees between a full swing and this one. The essential benefit of this machine is that the cold specimen is placed loose on the anvil and broken virtually instantly before it warms.

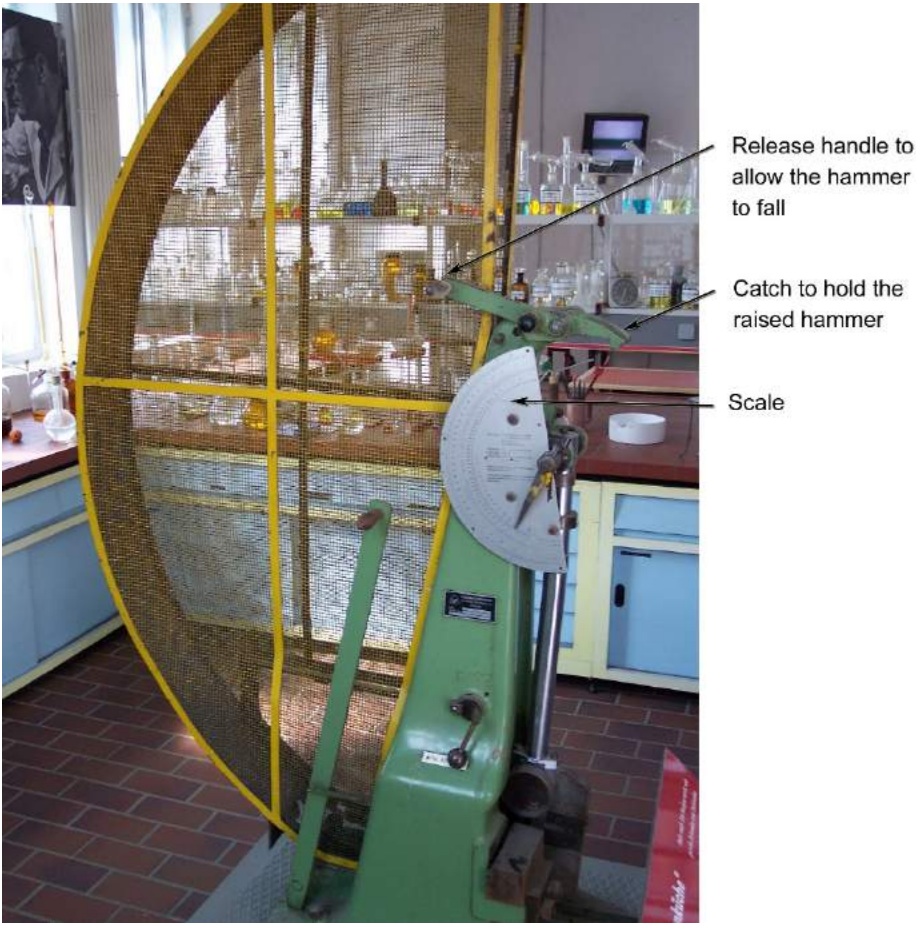

Image 9: Charpy impact tester

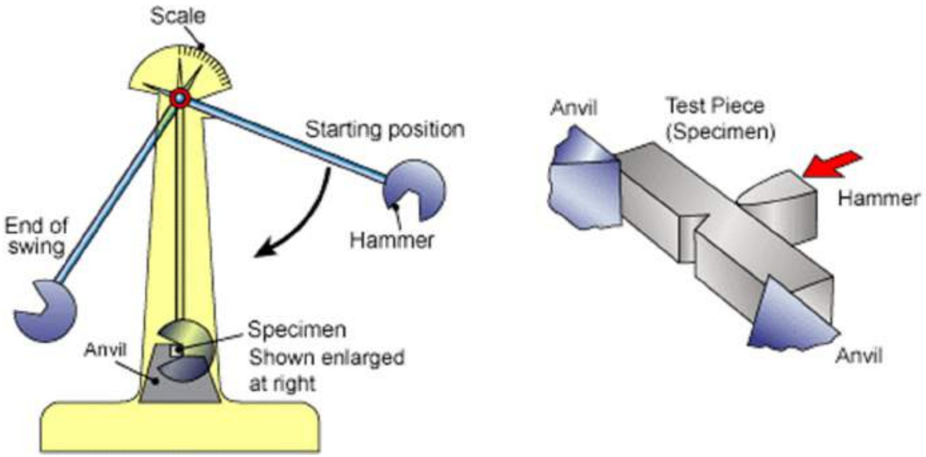

Image 10: At the top an enlarged test piece sits against the anvil as the weight/hammer hits it immediately opposite the notch. A small image of the test machine below the test piece illustrates the action

Full of confidence Hoskins airfreighted their specimens to be notched and tested. They failed dismally. So did the next set and the next and the next and on it went. Every weld technique we knew or could read about brought the same result, thousands of dollars were being spent and the company was in deep trouble. Vickers UK was asked for advice and they sent out a very senior welding metallurgist from Barrow in Furness to help. It made no difference. Testing slowed, spirits plummeted and we should never have got into this.

Then the Hoskins Charpy machine arrived, was installed and calibrated. A double set of test pieces were prepared. Half were tested on the Hoskins Charpy half were air mailed. The Hoskins specimens all passed handsomely to local jubilation. Then a day or so later news arrived that the others had all failed as before.

A Charpy test specimen can be notched in two ways. The notch can be milled as a V notch or drilled as a small hole then cut to keyhole by hand with a

hacksaw. Our helpful colleagues in the east milled, Hoskins drilled. However what is not acceptable is for the two methods to give different results. It is possible for a drilled hole to be bad but not if it is drilled carefully by a skilled toolmaker. The Hoskins test pieces were correct. The Hoskins welding was exemplary.

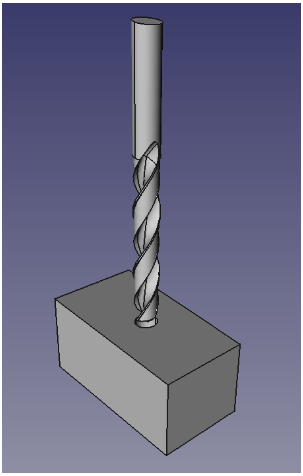

Image 11: Notching by drilling

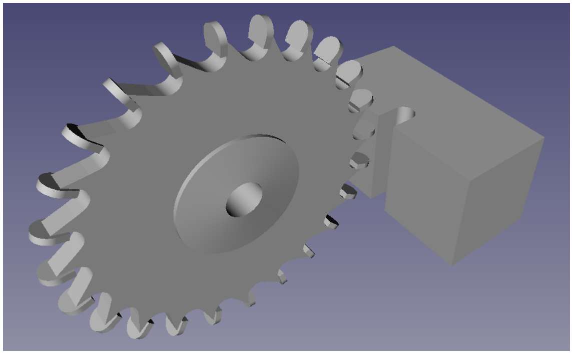

Image 12: Notching by milling

The laboratory in the east took the problem to heart, chastened by the derision of their own colleagues. It took them about a year of milling cutter grinding, projected profile analysis and machine setting variations and in the end they got there. They could mill and get results comparable with drilling.

John Callow was mercifully spared all this drama but his time was at hand. He wrote what follows himself.

"In 1959 the British and Australian Governments were developing the Woomera Rocket range in South Australia. They called tenders for the construction of very large liquid oxygen tanks to an American design. These

tanks were similar to a large thermos flask. The inner tank, nine feet in diameter and over forty feet long had to be made of stainless steel and placed inside another tank, made of ordinary steel, eleven feet in diameter. The space in between tanks had to be evacuated and tested to show that they were leak proof. The construction and testing of such a large vacuum space had never been done before in Australia. I was asked to look into the type of vacuum pumps and other equipment required for doing the work so that the cost could be estimated. I, and nobody else in Australia, had previous experience in this sort of work. Finding out what type of vacuum pumps was required was relatively easy. Finding out if there were any leaks and exactly where they were, was quite a different matter. I discovered that in the USA, helium gas and a special instrument called a helium mass spectrometer had been especially developed to do it. The problem was that at that time the USA had a monopoly of the production of helium, which was collected from Texan oil wells, and banned its export except for research work. In England, a different but much less effective method and instrument was used. We had to allow for using this method and I was quite worried about that, because if our tender was accepted, I would have had to supervise this work and was not confident that it could be done successfully.

We were awarded the contract and I was very relieved when we were told that the Australian Government had been successful in getting the US Government to lift its ban and was prepared to supply the helium and the special instruments required, to the Australian Government. I went to the Aeronautical Research Laboratories in Melbourne to learn how to use the instruments and the techniques for finding leaks. They usually occur at the end of a weld. We successfully manufactured and leak tested six of these vessels. I believe I was the first non-government employee in Australia to use helium and a mass spectrometer for leak detection.”

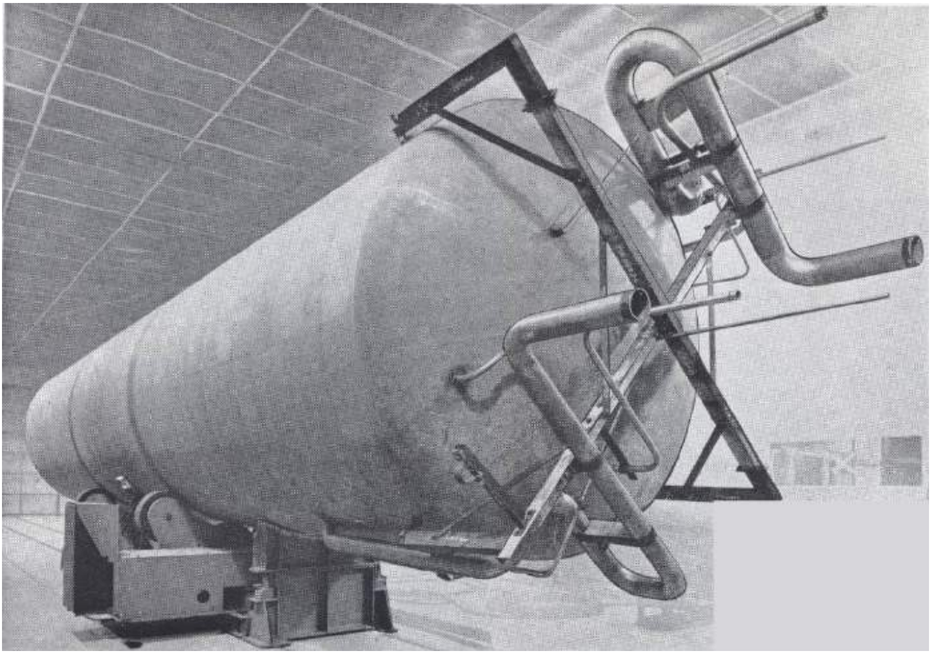

Image 13: O2 tank

Of course John was correct about all he wrote. To put this into terms of measurement, atmospheric pressure is measured in millimetres of mercury. Full atmosphere pressure supports a column of mercury 760 mm high. Each mm is 1,000 microns so an atmosphere is 760,000 microns.

Finding a leak in vessels of this size is fiendishly difficult, pumping down a vacuum space of this size to a few microns of absolute pressure when it is full of pearlite is unbelievably slow regardless of the size of the pump. At these pressures remnant gas to be removed is all at such low pressure it is difficult for the remaining pressure to push it anywhere. It needs force to move it towards the pump and the pressure everywhere is so low the force available is minute.

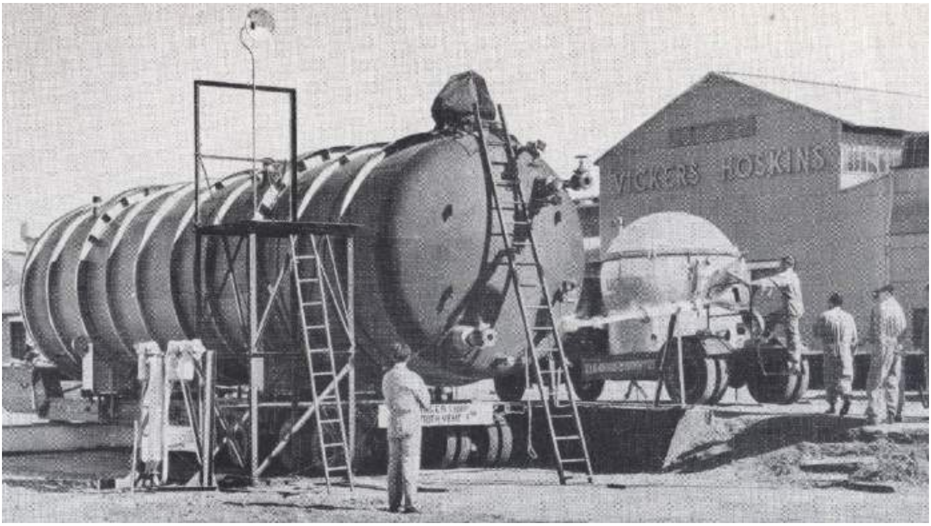

Image 14: O2 tank

When this remnant air is trapped in an obstructing bed of pearlite, pumping seems endless. Minutes of pumping from atmospheric to half pressure becomes hours to micron range, days to 500 microns and then weeks to gain 10 microns. Our target was less than 20 microns. This is 0.00003 of an atmosphere, in every day practical terms, impossible.

However despite every effort to keep the vacuum space and the pearlite dry, water vapour always has a contaminating presence. When liquid oxygen is pumped into the inner vessel it has the immediate effect of condensing to ice any moisture in contact with the outside of the vessel. There is an immediate reduction in the remnant pressure in the vacuum space. The outer surface area of the storage vessel 9 feet in diameter and 45 feet long is large. Over time other remnant moisture migrates to this surface and also freezes so once in service the vacuum is high and stays high and the insulation is exemplary.

Image 15: O2 tank

The key people and businesses were in place to enable the exciting and exacting container handling developments to occur.

The first new mechanisation

Early in 1960, William T (Bill) Peart, managing director of Vickers Hoskins in Perth, called Jim Shannon, the company's Technical Director to meet Jack Paterson and Adrian Boehme. They had a photo of a D container. Their question, "Could Hoskins make a crane to lift 5 of these boxes off and onto a truck tray at once?" Hoskins were established crane makers with a competent and experienced design staff and a comprehensive work shop. Jim said yes.

Jack Callow, the Company's senior design Engineer at the time produced a design for the lifting unit, Fred Blazey the structural design and the design draftsmen had plenty of previous examples to use as a basis for the rest.

So in 1961 Australia's first rail mounted gantry crane (RMG) for handing containers was installed at the McIlwraith McEacharn freight terminal in Brack St North Fremantle. Hoskins did not know it was a container crane at the time, to them it was just another crane.

It was commissioned and went into immediate and trouble free service.

Image 16: This is Australia's first container crane. Hoskins who made it, had never heard of a container crane. Now days it would be called a Rail Mounted Gantry (RMG) crane. The driver remotely controlled the two arms of the spreader to pivot in and slip the angle section bottom members beneath the containers. Then the boxes are lifted securely. 5 Boxes are shown, and any number up to 5 could be lifted. Later the spreader was modified to also lift top lift four boxes under a steel frame as a single unit. Later still and after the building behind was demolished, the crane top beams were extended so that the boxes could be moved to the right between the legs to space beyond.

The containers were placed in line with their wooden gluts parallel to the truck tray. The scissor lifting device had angle lifting members that gripped the bottom of the containers to engage them. The trucks travelled just a short distance to the ship's side on Fremantle North Wharf where the boxes were individually handled by slings lifted by ships union purchase gear or

wharf cranes. As soon as a hold was partially discharged the trucks delivered out going cargo boxes to the ship and returned to the terminal with inbound boxes. Once on the pavement at the terminal, the boxes were handled by fork lift trucks. In a hold they were manoeuvred manually whilst still suspended and then placed.

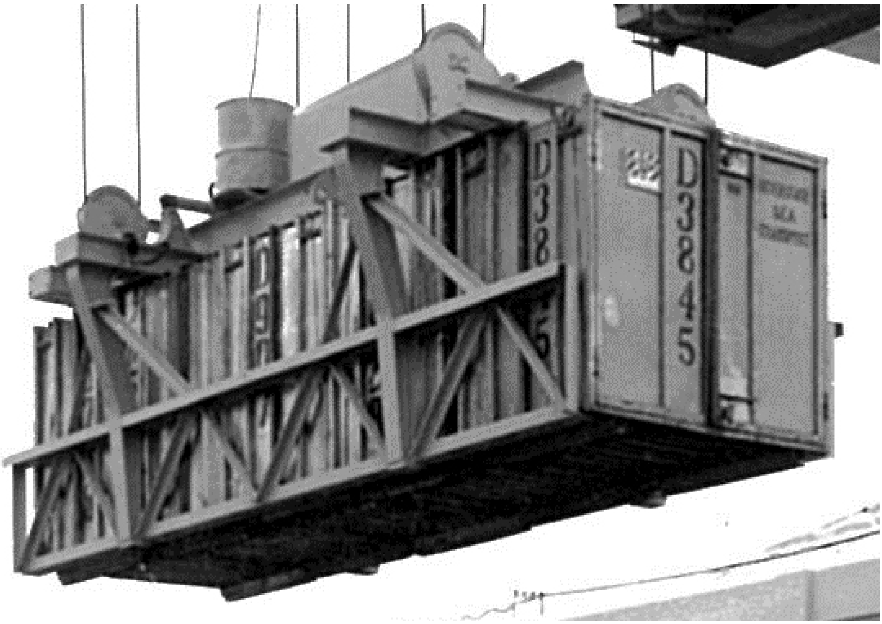

Image 17: This shows clearly how the bottom lifting plates slipped in under the container corner into the space created by the bottom timber bearers (gluts).

Over time the crane was modified several times to top lift multiple D containers, Australian A containers and the cantilever was extended at the other end of the gantry to work both sides external to the terminal rails. It became known to its users as “the old girl.”

The crane performed its duties virtually trouble free with minimum maintenance and no accidents, but one event illustrates that sound

engineering, sound construction and adequate maintenance can always be upset by unexpected circumstances. The soil of the terminal was sand. Sea sand. It was a well-drained stable base and very good if it is adequately consolidated. The footings were concrete, wide enough and reinforced to spread the loads. All of these conditions were satisfied. However after about a year of service a single local subsidence appeared under a short section of one rail. The operators noticed this and McIlwraith asked Hoskins to investigate. Well below the excavation and rail concrete support beam, an old well with a brick perimeter was found. It had been filled with rubbish including steel scrap and covered over by sand consolidated to carry road traffic.

It could have been found by testing the consolidation before the concrete was poured for the crane, but the testing is usually performed at spaced intervals and the well was small. It was missed. McIlwraith had purchased the property and was not aware of the well. No damage resulted and once identified the problem was tedious but easily overcome. This was a good outcome because there were no injuries and no crane damage. This result was achieved because the operators and their supervisors were alert and interested.

In the 1950's and 60's most overseas shipping came from England or Europe and called at Fremantle first. That was, for the visitors, the first Australian port of call. The ships were worked and bunkered here before carrying on to Melbourne and again before returning to Europe. Bob Leggat, the stevedoring manager at Fremantle, saw them first.

Capt. R.C. (Bob) Leggat

Bob Leggat has a unique place in Stevedoring management because he participated in the development of D box handling and later became the first to see and report on a trial demonstration of the Callow twin lifting design arranged in the Hoskins workshop. When the overseas container service commenced in 1969 he was the first to put the twin lifting system into successful service.

Bob was an Englishman who started as an apprentice with Shaw Saville in 1942 or 43. He did not tell his parents he had applied for the position so we can assume he was a modern example of an old tradition "running away to sea". He survived the last two or three years of World War 2 without an air or submarine attack and worked his way up command to master. He married Iris an Australian living in the UK and after 10 or 11 years at sea, swallowed the anchor, paid the sea fares and with Iris and their son, migrated to Australia at the end of 1953.

He came with the promise of a stevedoring position in Fremantle. Along the way out he received notice that his job had been filled by someone else and travelled on to Victoria. On arrival there he received a message to contact a Mr Edwards Chief Manager of, McIlwraith McEacharn and was offered a job as a stevedore superintendent back in Fremantle. He returned there in the pilot's cabin of Kanimbla to take up the job. After about twelve months the company chief of stevedoring at Fremantle retired and Bob succeeded him.

In those days Fremantle was the biggest bunkering port in the southern hemisphere and McIlwraith arranged some of this. They also stevedored the discharge and reloading of many coastal and international ships. The planned intention of the coastal vessels was to arrive in port first thing

Monday, work all week and be at sea again by the following week end. This program was designed to control the costs and time in port.

As reported earlier in ”The Beginning” the average cargo handling rate when discharging or loading and stowing was about one tonne per hour per worker.

When cargo was consolidated into three tonne D containers, each 6 feet wide and 6 feet high and 4 feet long and they were packed and unpacked remotely from the wharf and lifted from trucks parked alongside a ship, one at a time by the ships gear or wharf cranes, the handling rate increased by an average multiple of 15 or 1500%. This despite limitations imposed by ship hold flooring weaknesses.

These successful methods attracted attention in all McIlwraith ports and they shared experiences between them.

The D containers were carried on trucks two wide. In many cases clients used their own fork trucks so they became pioneers of door to door sea freight. For them it was quick and secure and economical. For smaller parcels McIlwraith provided an off dock packing and unpacking service.

Bob Leggat managed the Fremantle Stevedoring operations of McIlwraith McEacharn and Associated Steamships until he retired to take on a new role as a suburban office supplies shop owner.

The next step

In late 1962 or early 1963 Jack Paterson and Adrian Boehme revisited Vickers Hoskins. They had new plans. Their board had approved building a new specialised container ship for coastal service designed to carry container cargo only. It was to be worked by new gantry deck cranes and supported by freight terminals in Melbourne and Fremantle. The design and construction of the deck cranes was not a problem for Vickers Hoskins but they recognised that due to their lack of experience with marine cranes some important sea requirements could be missed. Jack and Adrian produced a marine magazine that identified the Pacific Coast Engineering Company (Paceco) of Oakland, in San Francisco Bay and suggested Hoskins negotiate with them. Bill Peart set off to do that and returned with a licensing agreement to represent Paceco in our area which was Australia, New Zealand, and countries to the near north.

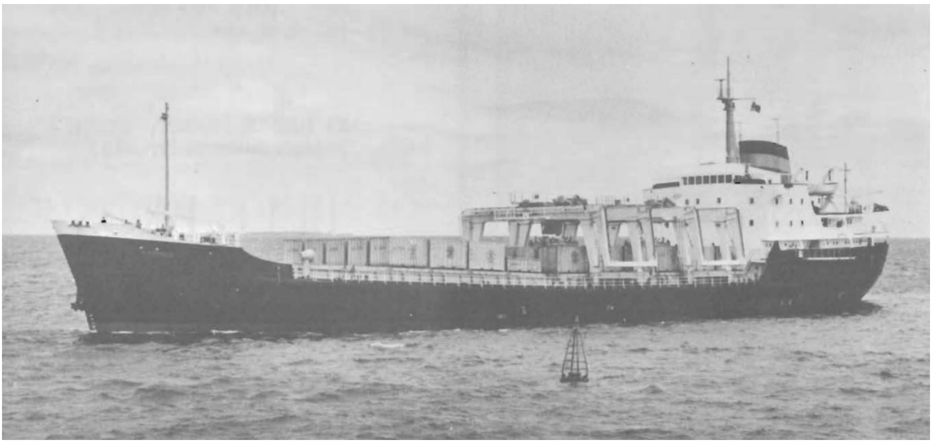

Image 18: Kooringa at sea

The new ship was to carry the new big standard Australian containers each 17 tonne gross, 16 feet 8 inches long 8 feet high and 8ft wide. These were called "A" containers. These were to be stowed above and below deck. Also below deck there were 6 feet wide cells for 16 feet 8 inch long packs of the D boxes suspended below a single frame. 6 feet wide car pallets were also carried in the same cells. The ship was called Kooringa.

The crane structures and sea lashing systems were designed by Paceco, the trolley and mechanical equipment by Hoskins. Paceco also advised that GE should supply the electrical equipment and Hoskins specified that the electrical interlocking switches were to be chosen from a list of US navy approved weather deck equipment.

By today's standards the ship and crane electrical systems were primitive. The ship generated 250 V DC. It was arranged to be +/- 125 V because this allowed the use of a simple two lamp in series, earth fault indicator. An earthed central connection was made between the lamps. If one lamp became dull or extinguished and the other became brighter there was an earth fault somewhere. It was often needed.

A DC to DC crane generator set provided variable voltage DC power for the shunt wound hoist, trolley and gantry motors. Shunt wound motors run at a speed that is proportional to the armature voltage so by using a system that allowed the crane driver to vary the voltage of the applied power, stable speed control was available. The gantry drives turned pinions that meshed with gear racks welded to the deck of the vessel.

The ship was built at State Dockyard, Newcastle. The cranes and racks were built at Hoskins and freighted to the dockyard. Jim Shannon stood by to see them erected, commissioned the electricals, and prepared for the testing.

This testing was unusual. The vessel was "light ship" in the extreme. There was no cargo, no ballast, no fuel, no water, no crew and no stores. She sat on, rather than in, the water. The test load was assembled alongside on the wharf. The ship architects attended to verify their stability calculations. There was an industrial dispute because two different unions claimed the right to do the driving. After much negotiation it was determined that Jim Shannon would drive as "manufacturer's representative" with a member of each union wedged into the cabin behind him.

The load was engaged, and then lifted. It did not lift. Instead the ship rolled. It rolled and rolled and rolled. Dock lighting poles and buildings that started well below the crane cabin came up alongside it and then passed above. At last, the load floated. Jim looked back triumphantly to his two passengers—but they were gone, no longer anywhere to be seen. Jim's right to drive was established, confirmed and never again contested.

The vessel berthed at Victoria dock Melbourne loaded and sailed her maiden voyage to Fremantle in June 1964. Jim Shannon stood by while she loaded. Ken Urry the mate who would normally have been busy supervising the stowage of conventional cargo, instead checked the vessel stability model and related this to the cargo actually being put on board.

The working crew, truck drivers and crane drivers had all been briefed by Bob Merry's stevedores. They were interested, keen and cooperative. The loading went smoothly. Jim Shannon ate in the ship's mess and got some sleep in a vacant cabin. The second night he went back to his hotel. After midnight the phone rang "a container has been dropped". When it was clear no one was hurt Jim said "ask the driver to stay in the cabin but not touch the controls. Do nothing, wait for me to arrive." They did precisely as asked.

Jim climbed up and into the cabin and the driver recalled what he had done and what happened in sequence. Back on the deck with a borrowed tape measure and close to the hold where the container sat at an angle supported on the top of cell guides and with three spreader hooks still engaged, one tape measurement was enough.

The spreader had four corner lifting mechanisms each with a Matson hook to engage the container. To allow the spreader to engage 8 feet wide and alternately 6 feet wide containers, the corner lifting mechanisms were mounted on slides. The slides were activated narrow /wide by hydraulic cylinders and in turn solenoid valves under the drivers control. To keep the corners set at the required spacing, the solenoid valves and cylinder pistons were hydraulically locked.

A spreader suffers worse violence than any other part of a container crane. It lands with a thump, it is snatched into the air with a jerk, grabbing the container as it goes and shoulders its way down cell guides. For this spreader the hydraulic lock was not enough. 8 feet wide boxes were loading and had been for some time, the hydraulic fluid in the cylinders or valves leaked enough to allow one corner to be battered inward away from the 8 feet setting. The corner was unlatched even though the hook was still held in the latched position.

Jim explained what had happened and asked the drivers to reactivate Wide (8 feet) control momentarily before lifting each box. This they did and by mid-morning next day a temporary fix was in place to prevent a repetition.

The passage West was rough. The ship demonstrated a very pronounced ability to roll and caused relative crane movements that showed that the purpose lashing system should have been tighter. Crew members were

alarmed and “she will roll on wet grass” was one of the few printable remarks.

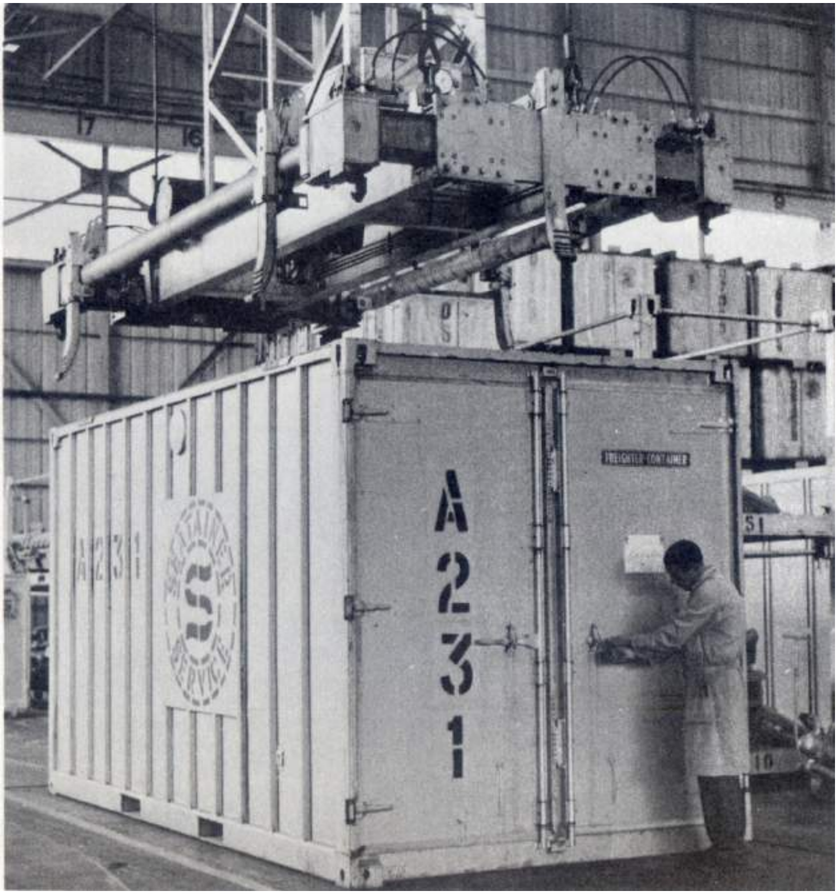

Image 19: This illustration of a 16 ft 8 inch A container shows it in a terminal with the spreader of an overhead crane about to engage it. The Matson Lifting hooks are seen one at each bottom corner of the spreader. The corner slides that allow the spreader to change from 8ft to six ft wide are clear.

Measurement	Internal	External
Length	16’ 02”	16’ 08”
Width	7’ 08”	8’ 00”
Height	7’ 09”	8’ 06”
Gross deadweight	17 tons	
Cargo Capacity	14 tons, 10 cwt.	

As the Kooringa departed Fremantle for Melbourne to complete her maiden passage east, 50+ knot storm winds gusted across Gage Roads. By the time she was off Busselton, the wind had increased so much that Capt. William (Bill) Uttley ordered her hove to, to save the deck cargo. After wedging against the disorderly motion of the almost stationary vessel in a storm for 16 hours, a relieved Chief, Colin Clark responded to “full ahead” and with the wind nearly astern, big swells following and the Sulzer at full song she surged her passage across the southern ocean as the clipper ships had done before to arrive in Melbourne in 4.5 days and be back on schedule.

Between slipping’s, Kooringa maintained a two week return voyage between Melbourne and Fremantle without interruption, but not without effort until 1969/70. Ship mounted cranes in any service are very vulnerable. Crossing from Melbourne to Fremantle regardless of weather and sea conditions to a tight schedule all year round is taking “vulnerable” to a heroic level. In sailing mythology the southern ocean across the Australian Bight rates with the Bay of Biscay as very dangerous and a place to avoid in bad weather.

On occasions Kooringa berthed in Fremantle with deck containers stove in forward and their cargo washed out overboard and onto the deck. As sea water was drained from the US Navy weather deck switches and machines it sometimes seemed to the maintenance crew that the US Navy may have a few problems. Progressively Hoskins rehoused the fore and aft gantry drive

motors during time in port and filled the switches with transformer oil to minimise their air content.

Image 20: Kooringa crane handling an Australian A container. Near the bottom centre of the image the crane rail and deck gear rack can be seen. Above the container the crane folding birdwings are extended over the wharf and the trolley has runout over them. The 6 ft to 8 ft extension corners on the spreader that caused trouble in Port Melbourne are easy to identify. The bottom birdwing pivot pins withdraw to allow the birdwing to fold down ready for sea and then a section of the birdwing acts as a stop to prevent trolley movement over the side.

Despite the ongoing maintenance and weather problems, the ship set new standards for service, reliability, frequency and the lack of cargo loss or damage. She was also profitable.

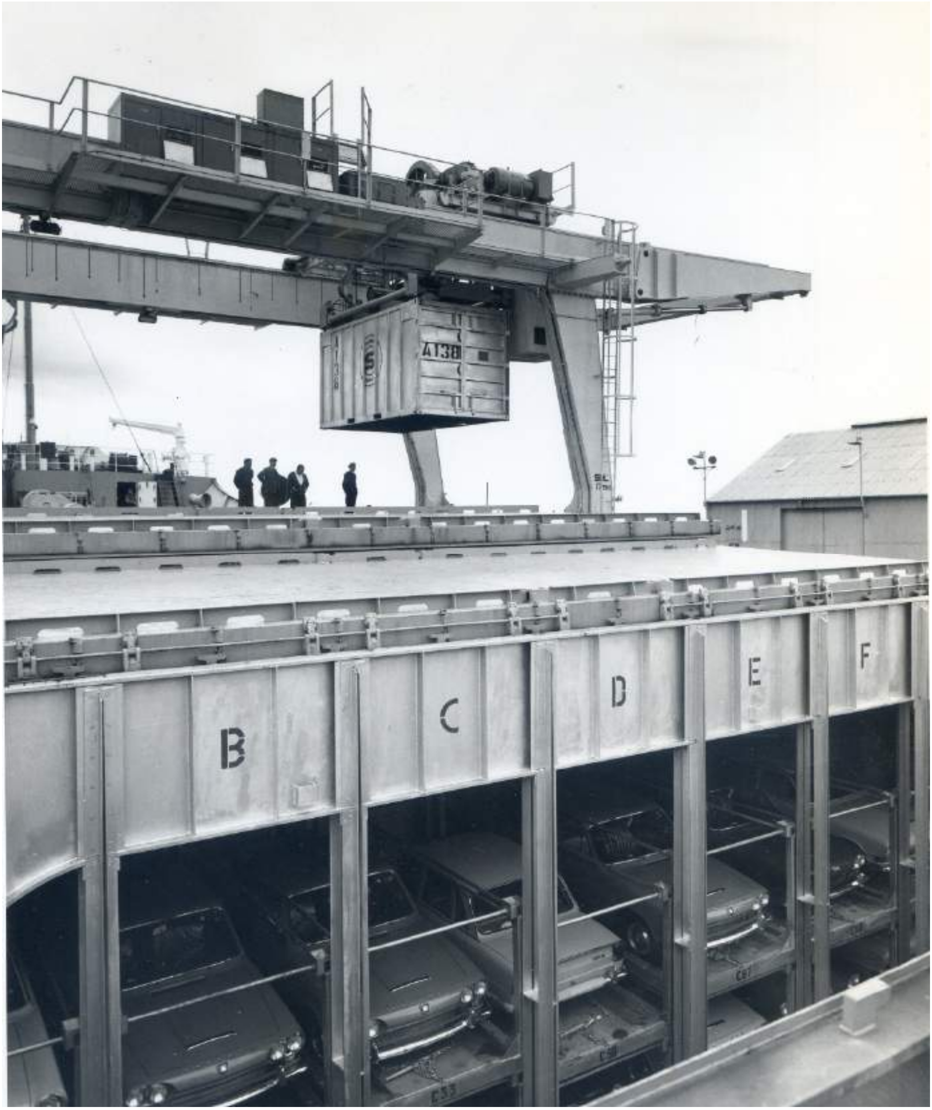

Image 21: At the bottom of this view, a row of cars on special pallets are occupying the same 6 ft wide ship cells as the D containers

Image 22: Here four D containers have been attached to a top steel frame in a cargo terminal and then trucked to the wharf. Then they are lifted by the Matson hooks of the crane spreader and are on their way to stowage in a Kooringa hold. The bystanders are dressed somewhat differently to wharfies so what they are doing is unclear. Behind the nearest of them a further set of 4 D boxes can be seen on a truck.

Melbourne terminal

As part of their preparation for working Kooringa, McIlwraith McEacharn built a large storage shed on Sudholtz Street, Port Melbourne within a short distance of the Kooringa berth on Victoria Dock. This new facility surpassed the existing Fremantle Brack St terminal because it received cargo from both rail and road and packed it for later loading to Kooringa. It also had Fremantle as a model so it improved on the layout. Captain Bob Merry the appointed manager had, like Bob Leggat come ashore and knew well the requirements of stevedoring. It was here outgoing cargo would be received and consolidated and finally incoming cargo would be despatched to clients. Access roadways and rail lines ran through the shed and packing and stacking space was available to consolidate and unpack cargo. Offices flanked the main area to accommodate the tally and record spaces required to control large volumes of miscellaneous cargo and keep a record of where it all was at all time.

The shed was covered by a large overhead electric travelling crane designed and provided by Vickers Hoskins that was equipped with an adaptable spreader having 16 feet 8 inch long x 8 feet or 6 feet wide container hooks with side guides to help alignment. This had exceptionally fast hoist and long travel speeds because they allowed extra time for the use of upper load control guides on the spreader that entered mating sockets below the crane trolley and prevented load swing so that a fully raised load could be accurately located to land exactly on top of others at any location below.

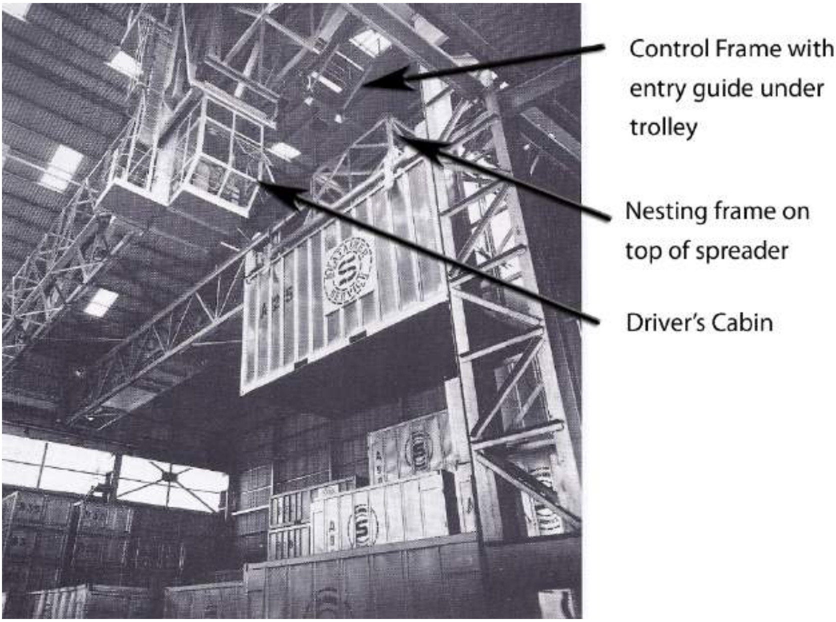

Image 23: A 16 ft 8 inch A container is attached to the crane spreader and at the top of the spreader a rectangular frame can be seen. Further up angled entry guides appear that will embrace the frame at the top of the spreader when it is fully raised. This prevents all load swing and misalignment as the crane stops over the selected position for the container in the shed. This illustration was copied from an article in The Port of Melbourne Quarterly April-June 1981 – Vol 30 N0 2 Written by Austin Stapleton.

The Stapleton text included 'A new documentary film "By Sea" produced for the Australian Steamship Owners Federation was now publicising the economic advantages of unitising general cargo in containers as well as palletising it. Centred on the operations of Troubridge, Seaway Queen and Kooringa. this film was now being exhibited in six overseas countries as well as throughout Australia'

This confirms that not only was Australia setting an example for the world, it was telling the world about it.

The shed was subdivided into identified spaces and the crane driver looked horizontally across the shed from his seat to align with long travel positions marked on the crane wheel support girders and at right angles to cross shed

markings on the crane beam to locate each one. Each shed space had an address of two horizontal positions and a vertical number. Records came from two way radio and paper forms. Work desk computers were not yet common.

The D containers came from and went back to the ship attached under steel frames, four at a time. In the shed they were separated and assembled to the frames by fork lift trucks.

New skills were learnt quickly. However no instruction was ever more effective than the sight of a container suspended from the crane with a rail wagon or truck hanging below it still attached but only to one end. A truck driver could sometimes react quite unreasonably, more especially if he owned the truck. This was no work space for a hangover.

At last shipping containerisation in America and Australia forced the rest of the world to act. They had already delayed decisions seeking a consensus and now had working examples to guide them.

The world in 1964

A very good year. Now the shipping world was seething. It knew it must act or leave the stage.

- Back in 1956 on the east coast of the US, Malcolm McLean had trial loaded 33 feet containers onto the deck of the converted tanker Ideal X.
- In 1957 in Australia, McIlwraith McEacharn loaded trial D containers into the holds of passenger/cargo vessels Katoomba and Kanimbla.
- In 1958 on the west coast of the US, Matson Navigation trial loaded 24 feet containers on to the deck of Hawaiian Citizen which was then despatched to Hawaii.

These pioneers had all gone on to do more. McLean had converted to 35 feet containers, renamed to become Sealand, converted ships to cellular and fitted them with gantry cranes.

McIlwraith had become Associated Steamships, designed and built and operated Kooringa, only the second containerised cellular vessel ever built from the keel up and the ONLY one to ever have cells of two widths and also to double as a car carrier.

Matson had converted vessels to cellular, changed them to cargo only and found a way to distribute their 24 feet containers between the Hawaiian Islands.

Standardisation

A world standard was a desperately needed, but it was a fearsomely difficult goal even though representatives of more than half of the world's people

were not consulted. In reality it boiled down to the Americans, British and the Western Europeans with sidelong glances at the Australians and Japanese. Every country wanted standards that would fit seamlessly into their road, rail and port systems and this was only to establish the box size and weights. Important items like lifting means and fastening systems, the strength of containers under load, identifying markings and more were still to be agreed. Keith Tantlinger, an innovative and very experienced engineer who worked in turn for Thoburn Brown Company of Washington State designing containers, then for McLean/ Sealand in Mobile Alabama and later Fruehauf, described it ruefully in the 1960's as a "time consuming dogfight".

By 1965 without final agreement it was clear the standard would appear as modules of 10 feet long 8 feet wide and 8 feet high. This meant that a 10 feet container was slightly shorter than 10 feet so that four could fit end to end in the same space as a single 40 feet container or two 20 feet units. Later the 8 feet height would become 8 feet 6 inches and also 9 feet and 9 feet 6 inches without upsetting anything else. The shipping world seized on the 20 feet and 40 feet modules as the units to concentrate on. Ship designs were started and in 1965, senior executives made a world trip to learn from the existing operations and help decide the other options.

When they got to Jim Shannon in Australia they had only one question left. Should they specify Sealand twist locks or Matson hooks to do the lifting? It was a good question because Australian containers on Kooringa had Matson hooking. Jim said "Twist locks".

In the end, sterling effort by the negotiators, fatigue of the participants and the sight of the three pioneers drawing away in front, forced decisions and in 1970 the International Standards Organisation (ISO) published the first of a series of nine standards. These specify twist locks. The patented twist lock

concept was invented by Keith Tantlinger and assigned to Malcolm McLean. Keith persuaded him to release it to the world without charge.

During the final ISO meetings small changes were made to the original Sealand lifting corners and twist lock hooks and they became neater and smaller and permitted less waste space in each box. Perversely this hindered easy engagement of the hooks and this has taken time to offset, although even now the offset is only partial.

This difficulty caused Hoskins to seek a solution which resulted in a patent with details in the references section of this book.

Before the ISO issued its printed standards enough was known about them to anticipate most final requirements and an anxious shipping community took action to order ships, rebuild berths and order handling equipment.

In 1965 there was a positive, even ebullient, business meeting in Oakland and a final lunch at a restaurant on Fisherman's wharf at the foot of San Francisco. The coming world adoption of international containerisation was the subject.

A jump into the future

Dean Ramsden owner of Paceco and his VP engineering Chuck Zweifel were there, as were Australians Jack Paterson, now Managing Director of Associated Steamships and his special Assistant Adrian Boehme. They were world leaders, pioneers. The world looked to them to show the way.

It is not entirely clear who said it first but somebody said “why not lift two containers together?” Additional drinks were ordered so this could be considered. By the time the Australians left for the airport to fly home it was decided. 40 feet containers would be lifted singly and 20 feet containers either singly or as twins out of separate but adjacent cells. They had ideas about how this could be done and Paceco undertook the task of providing details and applying for a joint patent.

In Australia berths were to be constructed at number 12 berth Fremantle, Swanson Dock in Melbourne and White Bay in Sydney. Dock handling sheds were planned for each location and shore based container cranes ordered. Vickers Hoskins was commissioned to build two overhead wharf shed handling cranes each for the Melbourne and Sydney cargo sheds and one for Fremantle as well as five ship to shore (StS) dock cranes. Plans were being made in Australia, USA and UK.

Hoskins first task was to develop the scope for the handling equipment and agree the subdivision of the engineering with Paceco. Fundamental ship characteristics to fix the crane outreach and height of lift came from the UK as did also the ship hatch sizes and weights because these were to be pontoon hatches with the covers lifted by the crane and put ashore. There they needed free dock space clear of cargo handling equipment and vessel

access. Temporary space for sorting misplaced cargo was estimated and of course the smooth transfer of cargo was the important purpose of the wharf.

Twin lift

Sometime later the twin container lift details landed on Jim Shannon's desk. The two 20 feet containers to be handled together were to come from axially adjacent (fore and aft) cells. This permitted 40 feet single containers and twin 20 feet boxes to be transported by common (modified) dock transport. When twin lifting it also meant working two adjacent ship cells, separated from each other by steel guides and crossbeams in the hold and as the spreaders emerged they were required to reconnect instantly to behave as one above the cells.

To do this each spreader was fitted with adjustable pusher arms at one end. On one spreader there was to be a pusher on the land side with a male end and on the water side a shallow female end. The second spreader was to have a reverse arrangement so that together they steadied and located each other. The pushers were to be adjusted in length to suit the cell spacing on each ship. As the cells were entered, the pushers were to instantly withdraw and, as the spreaders rose out of the cells, they were to be instantly reset at the correct distance. The male and female ends of the pushers were drawn as pieces of rolled steel angle turned alternately corner out or in, to provide the male /female effect.

The whole assembly was kept end to end by angling the hoist ropes so that they produced opposing horizontal force. In other words the left hand spreader pushed to the right whilst the right hand spreader pushed left.

The drawings provided were elementary because Hoskins was to provide the detail design and drawings and take responsibility for making the system work.

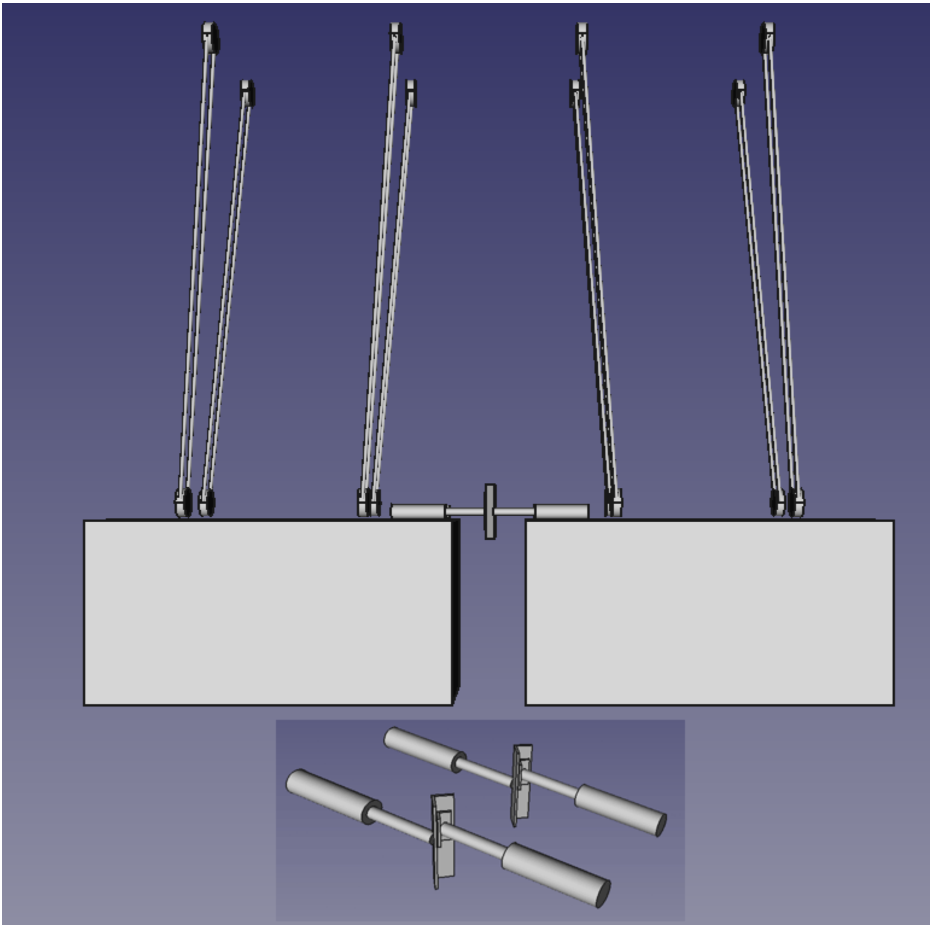

Image 24: The arrangement proposed by Paceco

Jim Shannon was horrified. There was no way it could work. There were many problems but for simplicity just one example.

> If one container was heavy and the other one light, the assembly would move horizontally end-ways out of alignment with the ship cells. There was no way highly productive interchanges could be

achieved because every container weighs more or less than the next. In the extreme case one is empty and the other fully loaded.

Hoskins client and licensors had worked together to devise, invent and patent something for Hoskins to design and make and it would not work. The situation was both desperate and delicate. Senior reputations were involved and Hoskins would share a responsibility for a serious failure.

MD Bill Peart was sympathetic but nonplussed. He said "do what you have to." Jim Shannon talked it through with John Callow, the engineer in charge of research and development, and said "please take a couple of weeks off and see if you can invent a solution". Jack demonstrated inspired understanding, invention, engineering skills, relentless drive and refined hand skills. In a day or so short of the time target he was back. He brought not only an invention, but very nicely made wooden models of spreaders, containers and cell guides to demonstrate it. It was a demonstration of genius. It became Patent 3,502,365. John Frederick Callow is named invertor and Vickers Hoskins the Assignee.

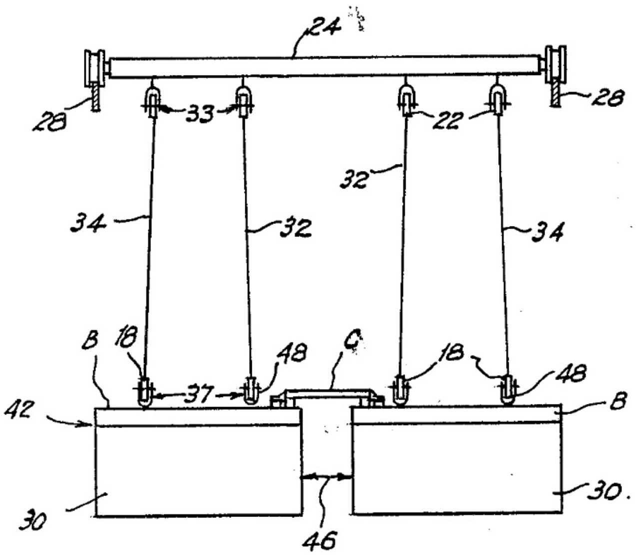

Fig. 2

Image 25: The trolley is item 24 on Figure 2 The hoist ropes items 32 and34 are shown as angled. This was never intended as a feature and in fact would have prevented the system from working properly, however it did not affect the validity of the patent, so was considered unimportant at the time. Items B are the lifting spreaders and Item C the mating frame. This was called the "gismotchee"by Chuck Zweifel of Paceco, and of course shortened to "gismo."

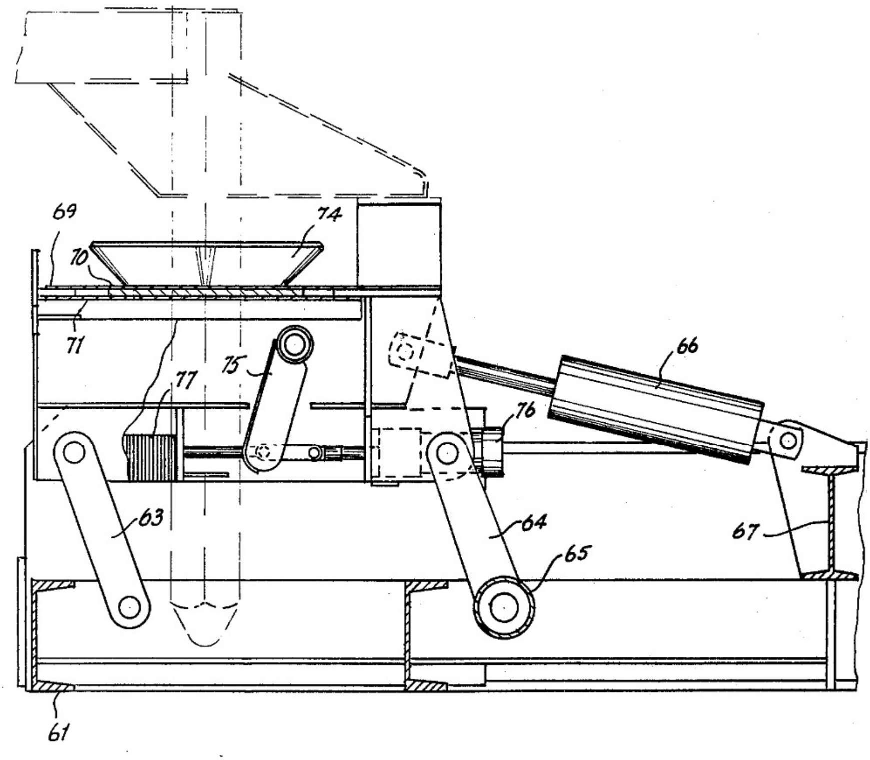

Fig. 3

Image 26: This illustrates the remote hydraulically operated mechanism at the adjacent ends of each spreader that changed the end spacing between the containers to suit the ship cell spacing over the deck and to suit the dock transport over the wharf.

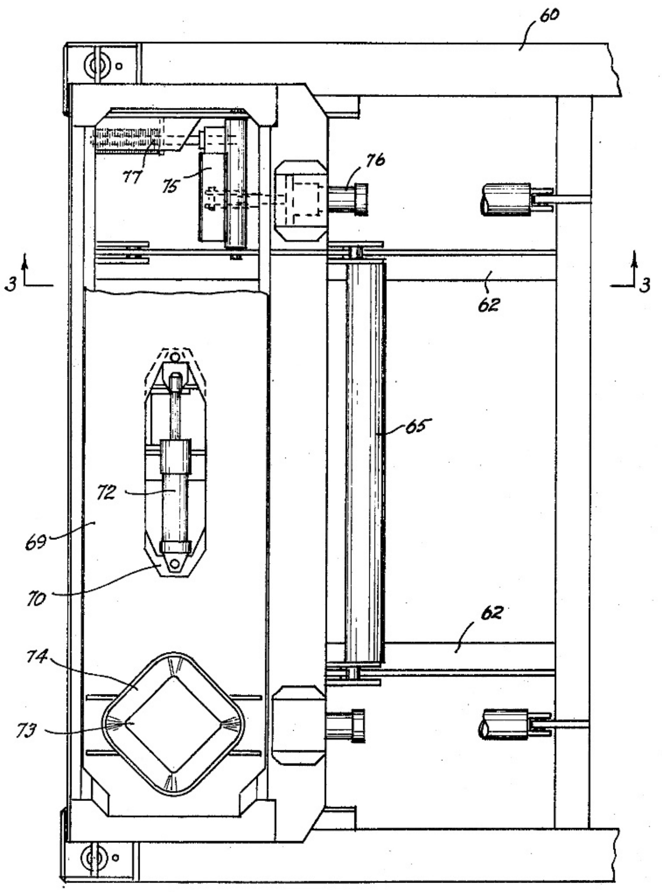

Fig. 4.

Image 27: is a plan view of the same part of each spreader that illustrates how iris plate openings increased in size to allow easy entry of the gismo legs, and then closed neatly about them to control the back to back container spacing as required.

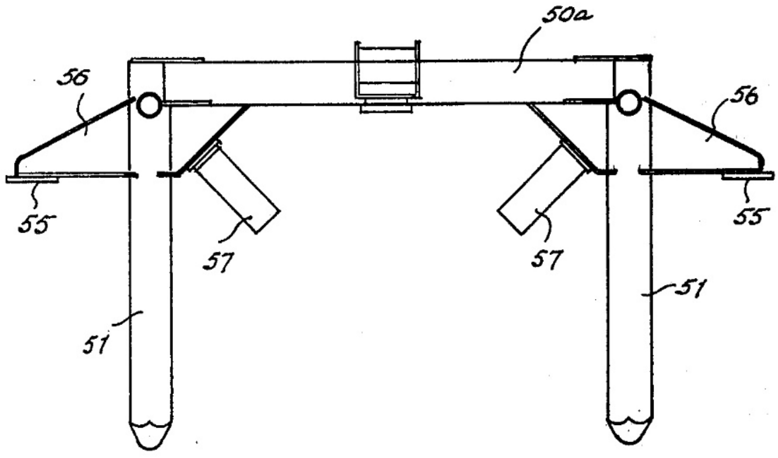

Fig. 5.

Image 28: An elevation that illustrates the gismo itself with fittings to balance it on the spreaders or on the cell guides as the spreaders entered the cells of a ship.

Jim invited Chuck Zweifel from Paceco and together they took the models to Melbourne and sold the outcome at a substantial gathering of McIlwraith senior stevedores.

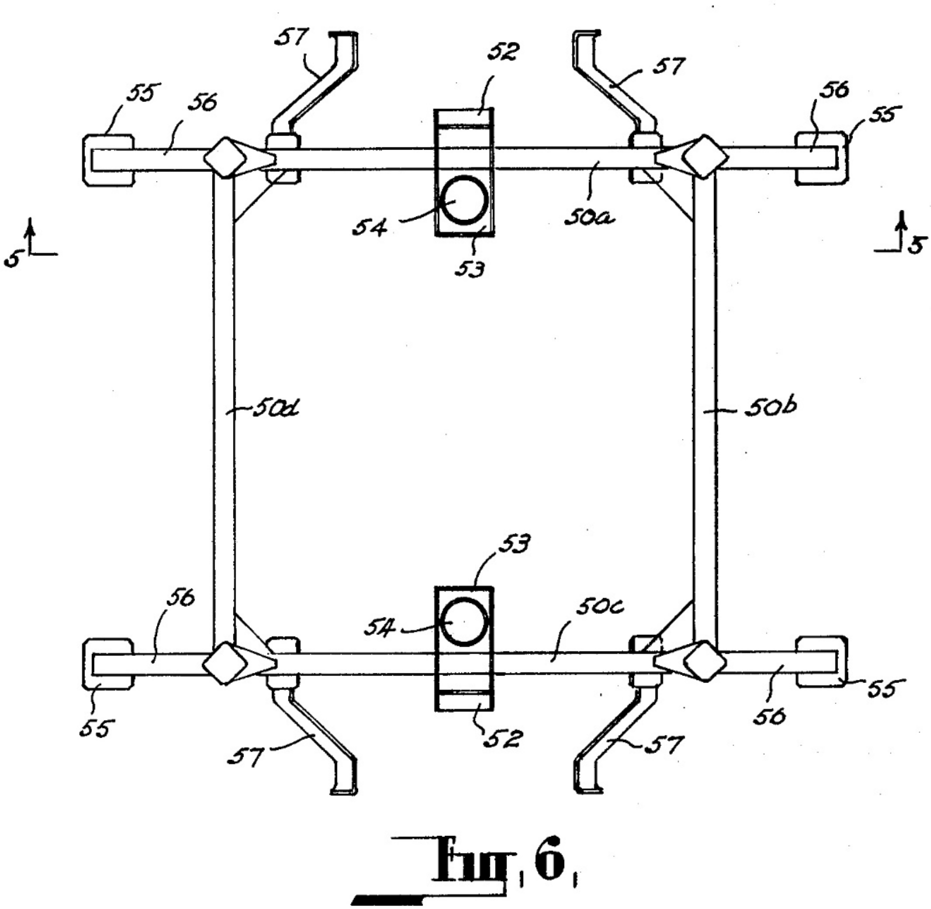

Image 29: A plan view that illustrates the gismo itself with fittings to balance it on the spreaders or on the cell guides as the spreaders entered the cells of a ship.

Managers of commercial engineering businesses and shipping companies keep their egos under control and recognise a proper outcome when they see it, so the Callow patent was accepted and the world's first twin lift crane went into service in 1969 in the Port of Fremantle. Some of its features are yet to be equalled.

Image 30: The Fremantle Port twin lift StS crane working Encounter Bay outward bound on her maiden voyage. Twin 20 ft containers are suspended as they are discharging from deck cargo. The man in the bottom RH corner is the NZ born supervisor who recognised the Meckering earthquake for what it was and ran to the wharf to check on the Hoskins commissioning team.

Image 31: Twin lifted 20 ft containers have just been landed onto a waiting truck. The connecting frame (gismo) between the two containers is keeping the space to that of the truck. The truck driver is in his cabin and when the containers are released from the crane he will drive them away to the nearby cargo terminal. There is a clear space between the ends of the containers as set by the remotely controlled adjustment of the setting maintained by the control system and the connecting Gismotchee (gismo)

The view is taken from the ships deck overlooking the deck cargo. At the foot of the image two containers still on deck can be seen. The end space between them is different from that of the two on the truck. This spacing change was preselected and occurred automatically as the crane spreaders travelled from shore to deck coverage.

Image 32: Fremantle Port has expanded. This image was taken in 1982. Two StS cranes are located on the expanded container berths, two ships are working. The nearest crane is taller than the first and has greater outreach. The forestays supporting the boom are now steel column sections. The electric cables feeding power to the trolley are now catenary loops.

The ship "Melbourne Express" is not one of the original Bay boats so new clients are calling. The near new 7.5 ton conventional wharf crane looks like a toy alongside these 65 ton lifting capacity container machines.

Image 33: This enlarged view of the twin lifting spreaders shows that the twin lifted containers are of different heights, and are lifted by spreaders set at different levels This was not noticed by the crane driver, the crane or the ship. It was routine. No modern twinlift crane can match this.

Image 34: This image is at the stern of the Melbourne Express to show she was also a RORO vessel worked from a specially equipped 12A berth

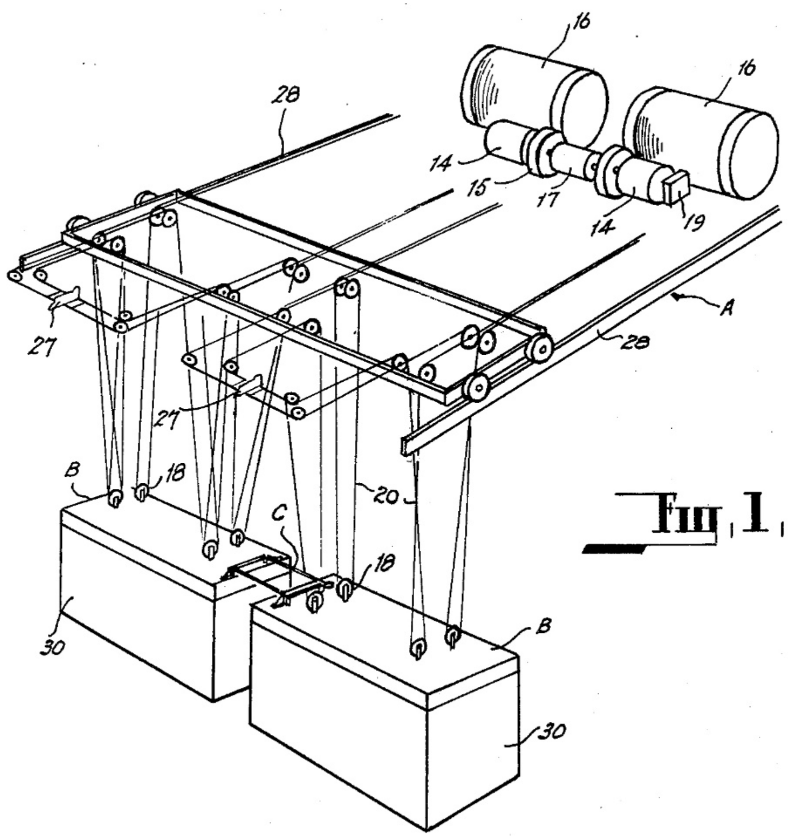

Image 35: An artistic general arrangement of the twin lift system. It shows the twin hoist units that are located in the crane machinery house.

Item 16 are the hoist rope drums, item 15 the gear boxes, item 14 are the two drive motors and item 19 the hoist brakes. Item 17 is an electrically released and engaged clutch. When engaged it locks the two hoists together so they operate as one. When it is released each hoist can operate alone.

The rail system allows the trolley to move across the wharf and along the boom over the ship.

Today a modern twin lift spreader has virtually none of the following advantages and despite this weighs 18 tonne. A reader may wonder, why is this so? This is further discussed in the section "Intellectual Property".

This crane had:

- the ability to lift single 40 feet and twin 20 feet boxes from one 40 feet cell space
- It could also lift twin 20 feet cells located end to end from adjacent cells that were separated by an intervening structure
- The ability to handle boxes of vastly different weight as twins. In fact a full container could be handled alongside an empty box or even none at all
- The twin boxes could have different spaces between the adjacent ends, on the vessel and on shore. The change occurred automatically as the crane worked
- The two boxes could be engaged and placed in, or withdrawn from their adjacent cells even if their stowed top height was mismatched to virtually any extent
- The twin lift system was a superior handler of 40 feet boxes because the location of the centre of gravity of the box was unimportant and also because it reduced load sway, and this without detriment to its ability to single lift 20 feet boxes
- The combined weight of the twin lift spreaders with their head blocks was less than 10 tonne
- The narrow profile of the twin lift system allowed it work closer to the ships gear and to obstructions such as the bridge than was possible previously

These points summarise the most important new features incorporated in this new crane, however there were others. At the summit of the structure the horizontal beam is short, just long enough to space the stays at the centres of the boom top chords. This reduces its bending forces and therefore the weight of this highest structure. To support it the crane legs bend inwards above the trolley support girders.

The boom and trolley support girders have the trolley girders running outside the bottom chords, this minimises the width and weight of the boom and trolley. The least amount of space is required between the ship bridge and the container cargo.

These features are now common on the best cranes in the world but these features were copied from Hoskins cranes where they were used for the first time.

Paceco undertook the structural design and employed Michael Jordan to make the calculations. Hoskins sent Jack Callow to California to negotiate all the preferred features.

The mechanical, electrical and control design, construction, erection and commissioning were all performed by Hoskins. Because these cranes were new in every way, full root mean square (RMS) calculations were performed for the most arduous hoist and trolley cycles. Independently force ventilated motors were selected to maintain cooling during slow speed and stationary periods. The drives were to be DC variable voltage shunt drives with light load field weakening of the hoists to obtain light load high speed motion and accelerations were boosted by up to twice full load current. Compensation for IR^2 losses was included.

The first crane commissioned was at 12 berth in Fremantle harbour. Detail commissioning was the task of the major electrical equipment supplier and

Hoskins monitored progress. All went smoothly until the full acceleration and running tests for the trolley. This drive was by wire ropes. In the machinery house the trolley drive motor and gearbox were connected to a rope drum. Fore and aft or, inboard/outboard ropes from the drum ran horizontally to the trolley pulling it outboard or inboard as required. This feature assists high speed handling because it can deliver high rates of acceleration regardless of wind and trolley wheel friction.

The trolley motor commutation proved unsatisfactory at high armature current and the machines were returned to the factory for modifications to the compensating field windings. On return, commutation was satisfactory but there was a stability problem. Prior to modification the faulty commutation had limited acceleration available so this was viewed as a new feature.

The effect was distressing. At the full speed position of the driver's control handle the trolley accelerated normally but overshot full speed badly. As the acceleration power required reduced at full speed, the over speed was detected by the control system and countered by full deceleration. Again the motion under shot full speed as it slowed and then promptly accelerated again to over shoot full speed. The cabin is attached to the trolley. It hangs below in clear space. The motion was violent enough to unseat the driver. He had to hang on. The drivers cabin is the size of a toilet, clear glassed on all sides and at the bottom, and looks down 11 m to the wharf and 14 m to the ocean, so for drivers this could be alarming as well as nauseating.

For those not familiar with electric drives, imagine driving a car along a level road at a steady 60 km/hour. When the car comes to a rise in the road the accelerator is left exactly as it was. Surprisingly the car accelerates violently up the slope reaching 100 km/hour at the top. Then it brakes violently to

40km/hour and at that point accelerates again to 100 km /hour. This is a repeating pattern whilst the accelerator remains at fixed depression.

Days were spent making adjustment to feedback circuitry in the speed regulator with consequent improvements to stability at the expense of poorer operating performance. There was a great deal of chatter between electrical and mechanical experts. The one solid theory by the electrical engineers was mechanical instability in the trolley rope drive system whilst the mechanical people were equally certain that the drive was electrically unstable.

Soon the first Melbourne crane was ready for commissioning and the trolley drive while not perfect was relatively stable. What was wrong with Fremantle?

The next move was to Sydney. This time the trolley drive was the most unstable of all, it was big trouble. Giving in to fatigue Jim Shannon said leave it “commission the boom hoist.” This was done and with little trouble the required raise time and sound control performance was achieved. Emergency stops and automatic sequences were established and tested. The final runs were recorded on a multi-pen high speed chart recorder and Jim took a copy of the chart back to the hotel to show Bill Peart who had arrived on some different mission during the day.

As they looked at it together an unexpected result was noticed. When the boom is being raised, the load is at its highest at the bottom and reduces as the boom lifts. This drive was running faster up at the bottom than it was at all other levels to the top. After a night cap and a call to Perth, Bill and Jim retired to their rooms.

Suddenly before dawn next morning Jim was wide awake.

To keep spare items to a minimum, the trolley drive and boom hoist motors were identical. Heavy load faster run. This motor had rising characteristics. Whilst this is an understood design feature for motors it is normally carefully avoided in industrial motors. They always slow a little with increasing load. For this reason adjustable IR compensation to counter this effect was included in the control system. Here there were pronounced rising characteristics.

The IR compensation provision in the drive regulator was making the instability of the trolley drive worse. Modern controls have a choice of features. Although these were somewhat elementary and required resoldering a few connections in 30 minutes it was done. With IR compensation reversed and adjusted to nullify the motor rising characteristic it took about 2 ½ hours tuning to establish a smooth responsive high torque drive that met every performance requirement. After weeks of frustration it was done in a few hours.

There is something unique about trolley motors on ship to shore cranes because later two other electrical suppliers, one for Wellington in NZ and one for Rotterdam Holland, supplied drives that exhibited the same features.

Image 36: This is the first Brisbane crane. Initially it was installed at Hamilton in the Brisbane river and later transferred downstream to be the first on the new Fisherman Island berths. It was a twin lift unit using the Callow System.

Image 37: This and the two images that follow show twinlift spreaders after 35 years service. The two central tubs collect and coil the multicore power cables that were suspended from the trolley above. These units handled the ISO 20 ft containers and are fitted with twist locks for connection to them.

Image 38: This shows the light construction of these spreaders and head blocks.

Image 39: Another view to illustrate the consequences of working ship cells.

Australia is a very stable place geographically but can produce surprises. One of these events tested the first twin lift crane with important civil and structural findings during its commissioning in 1968.

A very special event

On the 14th October 1968 Western Australia was celebrating the Queen's birthday with a public holiday. Garry Shannon, Jim's teenage son, was in the sewing room at home working on his electronic kit. At 11 AM there was rumbling, a pause, then the house shook violently. Picture frames swayed and fell. Solid objects pitched off shelves. "Stop that Garry" said Elaine, Jim's wife, then realising it was not Garry, she gathered the others and headed for a door. Western Australia does not experience earthquakes. No one had any previous experience of one so no one recognised this as an earthquake.

Nevertheless an earthquake it was. The centre was close to a rural town called Meckering 130 km east of Perth. It lasted 40 seconds and measured 6.9 on the Richter scale. The village was laid to waste. Masonry buildings collapsed and most of the others were severely damaged. Vertical faults up to 3 m high ran 40 km across previously flat paddocks and roads.

In Perth, glass, bricks and church steeples fell onto deserted streets, the Kwinana Freeway subdivided into diagonal jointed separate levels, of about 0.4m difference and pits of new subsidence as it followed the river through Como.

At Berth 12 in Fremantle harbour Bob Fairclough, an electrical engineer from GECA, the electrical equipment supplier, was in the machinery house of the new ship to shore crane with Jim Shannon. Hoskins electrical foreman Rod Banks was in the cabin as driver. They were commissioning the crane gantry drives.

There was a rumbling like approaching wind then the crane swayed and shook, the machine house made oval gyrations too violent to resist without

hanging on. Everything banged and clattered. The gantry drives are running amok - “kill the power”. As things came back to normal and bemused engineers moved from the machinery house onto the surrounding platform, an Associated Steamships manager came running onto the wharf. He was a New Zealand native, “that was an earthquake! Are you all right?” The answer is “if the crane rails stay in place, yes”. A Paceco Hoskins crane will not be damaged by a 6.9 Richter earthquake with an epicentre 130 km away.

State wide there were some injuries but no deaths. The public holiday saved many.

For all engineers and managers involved in water-front and sea-faring occupations, industrial relations is a significant part of their workload. The consequences of poor industrial management outcomes has forced the need for containerisation and influenced the way in which it has developed.

Industrial relations

Australia has a semi regulated series of relationships between industry and working labour. It is much influenced by the English Servant and Master relationships that do not really apply in Australia and has been based on conflict between the parties. It actually sets out to encourage conflict and has succeeded in guarantying this. It is in urgent need of rearrangement but unlikely to get this because a significant employment benefit is available to those involved.

Industrial relations is sometime called workplace relations, however the Author's preference is for Industrial Relations (IR) because this is a name that implies a system rather than a workplace. Our Australian system did and does not, always operate well. We started with the oppression of many workers who fought back and organised to get a better deal. Shearers, mine and manufacturing workers, sailors and dock workers all organised and won reforms that included revised law and a political party. It would be futile and foolish to ignore what has gone before and look wishfully to arrangements applicable in another country or to start afresh. Nevertheless we can consider change and revision that offers the prospect of modernising and improving possibilities for Australia.

Because this book is about containerisation and IR has great influence on this, thinking for the future cannot be realistic without including IR. Special features apply to IR and containerisation.

The first special feature is that much of what we need and trade must come from and depart our shores by ship. There is no way this will change in any foreseeable time frame.

The second special feature is that ships are costly liabilities alongside a wharf and able only to perform a commercial function at sea. In this respect they are identical in principle to trucks, rail rolling stock and aircraft but vastly exceed the individual capital cost and idle costs of the others.

These two special features provide the power that unionised labour has to negotiate for higher wages and privileges. All they have to do is stop work.

The effects are not hidden. Waterside labour costs exceed those for other manual, semi-skilled or skilled labour and the extra cost is paid by the Australian public in higher prices for imported products and by Australian exporters in lower returns for exported products.

The second effect also means that most coastal shipping is uneconomic and has been terminated. This increases the use of road and rail transport and clogs our roads. These disadvantages are also passed on to the Australian public in the form of road restrictions and delays and costs.

The consequence of high port labour cost has caused a worldwide determination to replace waterside labour with technology. The technology of automation. This is inevitable and will continue. However it is proceeding at a rate that is decimating waterside employment and contributing to the increase in the numbers of the unemployed who become unemployable. The reduction in wharf employment is occurring when we need all the productive work opportunities we can generate. The unemployed are direct costs and a percentage of them gravitate to anti-social activities.

We have three organisations that influence our industrial relations.

The Productivity Commission: These people are economic theorists. They can help with specific tasks if asked the correct questions.

The Fair Work Commission: The members are industrial jurists. In effect the industrial relations law courts. If you know what you are trying to achieve they can help by sorting the lawful from the unlawful and making rulings.

The Government: Our system is short term and adversary. It is very good at illuminating opposing points of view but is short of inspirational deep thinking leaders. It can legislate for real progress but needs a bipartisan project to achieve this with anything difficult.

For the purposes of this book it is the waterfront and seafarer unions and the stevedores who confront each other and initiate outcomes.

The Waterfront and Seafaring Unions: They are essential components but inhibited by past history. Their members include a majority of workers who can understand very well long term and sensible goals. They believe they need the protection provided by collective negotiation. However they can instantly differentiate between when they are being protected and when they are being bullied.

The stevedores: They are constrained by competition and the Australian Competition and Consumer Commission acts to ensure this is adequate. They may not trade whilst insolvent and must make a profit if they are to stay in business.

Before venturing into idealistic speculation or utopian planning, new ideas need to pass tests on history. Whilst this is outside the author's present purpose and indeed present knowledge, we can note. The working of cargo has always been spasmodic and of a casual nature. Shipping timetables cannot be perfect, the weather, imperfect machinery and human failings all play their part.

Casual or part time employment of dock workers has been the traditional solution. The almost automatic consequence has been corruption of the employment process with discrimination against the less fit and slower, universal. Occasionally an employer will preferentially hire those prepared to bribe for their job.

In response workers have developed attitudes that are kept alive by those who would manipulate. Stapleton records that Moises Woll reporting to a New York meeting of cargo handling executives gave US losses through pilferage of cargo as 7% of tonnage for 1928 to 1937 rising to 19% in 1946 to 1950. Even without supporting evidence it can be expected that some workers and some union executives would have regarded these figures as the attraction of cargo handling. Containerisation has stopped the pillage but the sense of grievance is still there to be exploited.

Now we have moved away from some but not all of the past problems. One enduring situation is that union representatives have only three tasks. One it to earn more than any of their members and keep this rising, secondly they must keep all their members in line and thirdly use their skills in negotiation with stevedores.

We cannot do anything without first deciding the task. This will require thought, planning and agreement. All we can achieve here is a start.

The Task

Do we already have the best IR system in the world? There will be few who will agree to this but maybe the majority is/are wrong. We are only talking about the waterfront after all.

Advantages of what we have

Wharfies have a high and privileged position. They earn about double the average income and work fewer hours to get it.

They come to the industry untrained and are paid to learn.

Their superannuation benefits are paid by their employers into their own choice of funds.

If they are sacked or made redundant their union will force negotiations to reverse the situation or have it compensated, even if individuals are culpable of serious misdemeanour.

Disadvantages of what we have

The waterside workers are excessively privileged and are subsidised by the Australian public, the community, to incomes higher than others of equal skill who work longer hours.

These privileges are causing employers to introduce ever more technological improvements that replace waterside workers with automation. That is capital replacing labour.

Employers are also moving cargo away from the wharfs as soon as possible and to the wharfs as late as practical to reduce labour costs even if logic and convenience would dictate otherwise in different circumstances.

Conclusion

We can conclude that long term waterside employment would improve and the race to automation could slow if a degree of cooperation and restraint were to evolve between the parties.

If we rely on history to guide us it is easy to believe no such situation will ever occur. However history can mislead. We have a well-educated community provided with timely examples from around the world and young new workers anxious to join the workforce at all levels. Our majority electors are keen to avoid the problems of other nations and to achieve this we must provide jobs.

Current examples of successful change

Our wonderful unbroken run of rising prosperity has paused. Of course the effects are uneven. Mining development and steel production have been hit disproportionately hard. A very wide range of services that support these industries is struggling to find new alternative clients. Steel works at Port Kembla and Whyalla are threatened with partial or even complete closure. The circumstances at Gladstone Nickel are worse but this is excluded because no marginal enterprise can survive the type of management it has suffered.

Port Kembla has made the most progress so this is our example for now.

The recent downturn in the world's use of steel has reduced its value to the point where it could only be made at Port Kembla at a loss. The consequence is straight forward. Trading at a loss is impossible for responsible management boards.

The effects of closure would include limestone, coal and iron ore miners laid off. Transport systems shut down, ships laid up. Wollongong going the way of Detroit in the USA, that is, empty buildings, rampant unemployment and vacant unmaintained houses.

Someone said "We are not going to put up with this. We are going to fix it in the short term and wait out the down times for better ones in the future."

They have set a common sense goal to minimise the damage. So far it is working.

Hopefully a temporary fix can also be found for Whyalla. It is yet too soon to tell.

The respite at Port Kembla provides notably useful examples to think about.

- The crisis came close to disaster before it was acted on. This is a pity because earlier attention by the investors (board) and workers would have made the eventual process smoother and possibly the final outcome better.
- All decisions were local and limited to the enterprise and community. In other words the workers negotiated for themselves and the board negotiated for the shareholders. Together they had ultimate authority and ultimate responsibility for an outcome they approved.
- Distrust between the parties was countered by allowing the workers to engage financially skilled representatives they trusted, access to company records.
- The Fair Work Commission supplied a senior Commissioner to chair critical negotiations.
- The state government recognised its responsibility to the community and its potential liabilities in event of failure, by agreeing to delay the imposition of payroll tax obligations.

These are timely and useful examples. They can be used again and rearranged to suit different circumstances.

Intellectual property

The Callow invention first entered service in 1969 at the Port of Fremantle. It was also used in subsequent Australian cranes in Melbourne Sydney and Brisbane and in second generation crane in Fremantle in 1982. It was also used in Auckland. It was also used in America however there are no records of when where and how often. The outstanding advantages of the design that the cranes using this invention had, are listed under "A jump into the future". At the end of the section improvements to counter operating difficulties imposed by strong union opposition are recorded.

Vickers Hoskins employees continued to invent and patent changes to the system including a safety interlock for latching mechanism invented by Jack Callow in May 1969 (patent specification 14099/70) and a self-aligning latching mechanism invented by Jim Shannon in November 1970 (Patent US3677599).

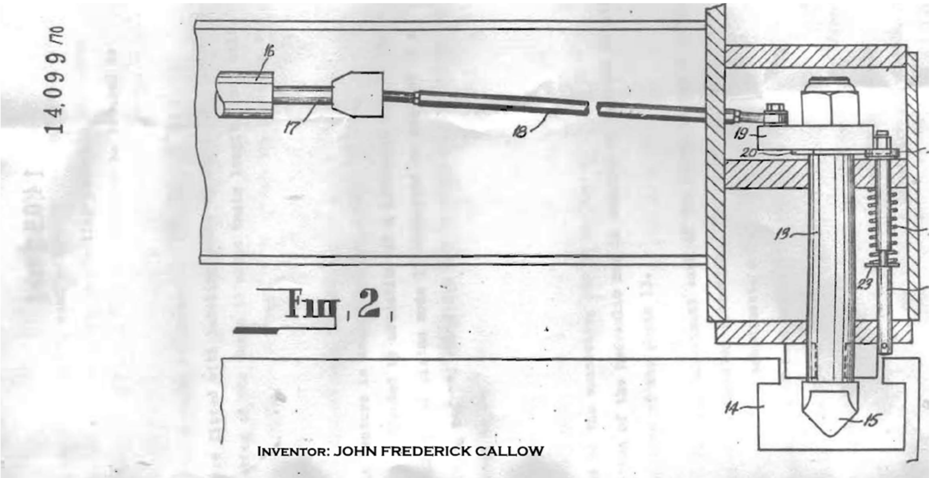

Image 40: Jack Callow Invention – safety interlock latching mechanism. This is the first Land Pin which is much shorter than used today.

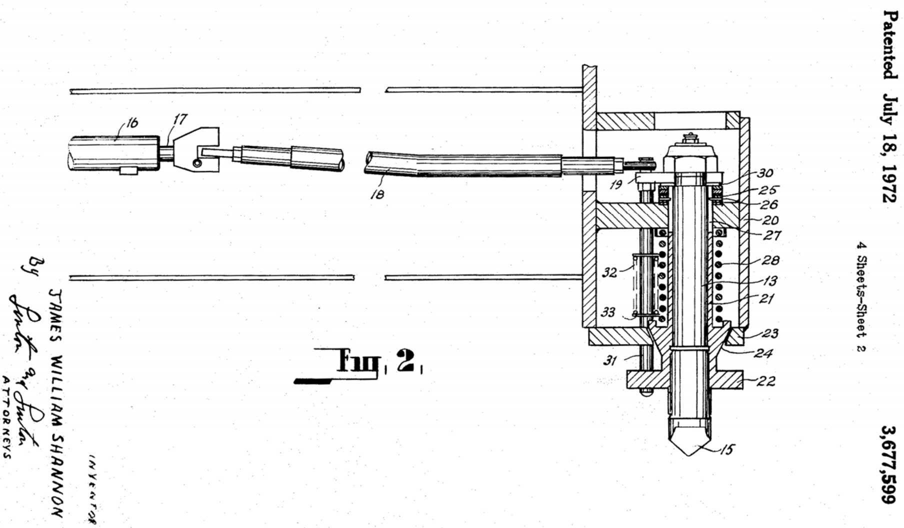

Image 41: Jim Shannon Invention – self aligning latching mechanism. In the section "Standardisation a brief mention was made of the difficulties the negotiators had to achieve standardisation.The last change to the twist lock design before ISO adopted it prior to 1970 had a detrimental effect on its ability to enter the container pocket.

See below

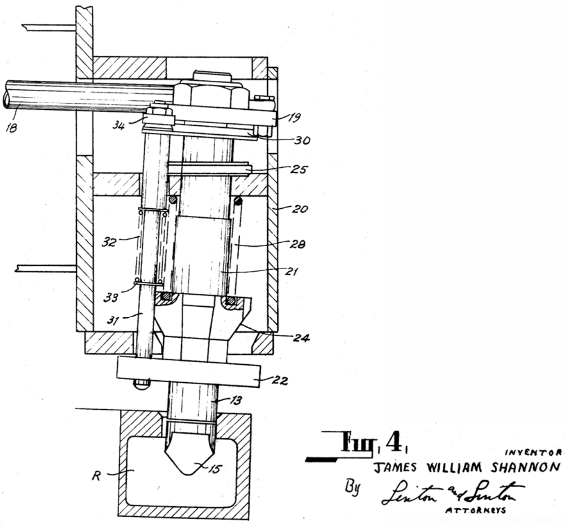

Image 42: Jim Shannon Invention – self aligning latching mechanism. The date is 6th November 1970. It was to ovecome the difficulties caused by the late ISO modification to the original twist lock pockets. If the twist lock and socket did not align, the twist lock was lifted out of its taper socket in the spreader and moved laterally as shown above to enter the socket.

In the 1970's and early 80's Hoskins remained busy with ship-to-shore and rubber tyre gantry cranes plus rail mounted gantry and overhead traveling cranes. Some were exporting to New Zealand and Hong Kong and through Paceco, to Cam Ran Bay in Vietnam. Second generation units were provided in Australia, however things were changing fast. Two serious competitors had developed their own designs in Australia and the world's traditional ship-to-shore crane makers had started to compete at any price that would get them a job.

In 1975 the Australian federal government cut manufacturing tariff protection by a whopping 25%.

Hoskins had by then a large manufacturing facility supported by a big design office, comprehensive metallurgical laboratories, a workshop planning system, tool room and specialist erection team. The manufacturing factory could not work effectively without these service departments but when the factory was not fully employed the service departments became costly burdens. The dilemma was that full scale manufacturing could not be provided without the services and services take time and effort to establish from new.

Hoskins reaction to the new competition, led by Jim Shannon, was to branch out as contract designers (i.e. engineering consultants), take in external metallurgical work and reduce indirect expenses. New products which were not pre-purchased contracts, were started Some of these like a chromium carbide faced wear product reinforced with a mild steel backing and a heavy diesel engine rebuilding facility succeeded. Some like an LPG storage tank manufacturing facility for light vehicle and car fuel did not.

At the same time it was clear that the Hoskins job costing accounting and record system had to be computerised. Jim put enormous effort into specifying and describing a new system that would match the usefulness of the old manual system but when the offers were analysed it was obviously too costly. Consultants were called to devise alternatives with disastrous results.

Heavy manufacturing moved offshore to lower cost countries. In the end there was no way Hoskins could keep its comprehensive facilities busy at a price that would match the costs incurred.

Now it is possible to look back on those frantic times and consider the decisions made back then. Of course they were not all made by your author and those others left may not all agree with his views, so only briefly Jim

reports that in his view now we should not have taken any work that would not have fully recovered costs. We should have closed sections progressively as profitable work dried up. In the end the result would be the same but the cash position would have been better.

When Bill Peart negotiated the license agreement with Paceco it was agreed that any inventions by Hoskins would become the property of Paceco, provided they took over payment of the ongoing patent maintenance costs. As the Australian market for container cranes faded Hoskins followed the agreement as it stood. Paceco built some Callow twin lift machines but also continued on with their own development to progress into the eventual automation that is still developing today. The Callow invention became unused, neglected and eventually passed quietly into history

This has been a repeating experience for Australian inventions and whilst your author acknowledges that sometimes we do better, he proposes we should always try to do better. We will continue now with the facts of this case.

To change from working 20 ft to 40 ft containers the spreaders were interchanged. The two 20ft units were released from the headblocks and replaced with the 40 ft unit. This was done by removing two multipin electrical plugs and manually unlatching two sets of four twist locks by operating two levers. This released one spreader set and the new one was connected by the reverse process. In total 5 minutes was required by one extra person and the skills equated to those required for changing vacuum cleaners from one floor to another in an office.

However containerisation in all its forms was detested by waterfront labour and the unions set about exploiting every weakness they could find legally and technically to stop and disrupt operations and force concessions from

stevedores by penalising their clients, the ship owners, with work stoppages. The exchange of spreaders became an Achilles heel of the system because unions were allowed to claim plug interchange could only be performed by an electrician and lever operation only by a rigger or fitter.

Even the relatively straight forward two port working of McIlwraith's Kooringa and Matson Navigation's island trade was a big challenge for those skilled in traditional cargo delivery and receival systems who were still using the same control and paperwork methods. They could not readily adapt to the handling intensity and ship stability requirements of containerisation.

When the effects of multiport ships, two container sizes and refrigerated, liquid and hazardous cargo were added for the European trades the complexities escalated by orders of magnitude. Great stress with consequent mistakes, loss of flow and double handling resulted. This increased the number of spreader interchanges required and they were obstructed by militant unions to slow output and to be disruptive and costly.

Hoskins developed an automated spreader exchange system for its subsequent twinlift orders so that the change could be accomplished by the crane driver alone. This overcame the problem.

The purpose of this section is to make a case for an outcome that provided an improved and lasting benefit to the people of Australia.

- We had a unique, securely patented invention with great commercial potential.
- It was constructed using relatively primitive components available at the time and capable of great and ongoing improvements as new sensing, measuring and control systems became available.

- Now it is possible to see that the light weight concept provides a means of achieving enormous civil construction economies for the new and remediated harbour systems.

We lost these potential benefits. Your author was one and possibly the only one who could and should have done more to prevent this loss. He now considers that making so much effort to only delay the closure of Hoskins works was wrong and that other more forward looking acts were required.

Knowledge of history provides our opportunity to learn from the past and avoid repeating mistakes as we look forward. We have proved to be an adaptable uninhibited work force with strong inventive capacity. We have had a poor ability to follow through and turn our front end skills into timely commercial success.

To tackle this, let us consider first our biggest past mistake. This is our faith, wish or even hope that the government should fix it. No notion can be more misguided. No serious thinker can believe that. So when we lobby, pressure or implore government we are only seeking self-help - in other words help for ourselves. We are asking a government to give us someone else's money. It is impossible to form a proper relationship with the donors and even more difficult to give them any sense of achievement. Even if we succeed and receive a grant, what we get will be misguided, short term, confused by regulation and onerous. Our real need from government is that it should stand clear.

The true nature of the most worthwhile innovation is that a need is discovered or a new discovery is found and then a great deal of hard work is required to convert it to commercial reality. What this amounts to is that considerable money is required because the most brilliant invention is

worthless until it is self-sustaining commercial. The most brilliant patent is there to be stolen unless it can be defended and the most brilliant pauper is there to be exploited.

Those interested and willing to be helpful are invited to lead discussion about a new proposal for the future. At the email address [jim@shaneng.com.au] Jim is very willing to collect your ideas and join the discussion.

Now to start this. The author's granddaughter has just returned from a Virology (science) conference in Texas bringing back with her a report of one seemingly successful research and development group working in the USA.

The leader has at present approximately 40 scientists funded individually to pursue their own research projects.

Scientists with a project to pursue seek an interview with the leader and after providing documentation, followed by many hours of exhaustive interview with him and further interviews with all their potential peers they are rejected or recommended for funding.

This is not by any means the only model but it includes the introduction of commercial successful risk takers to high potential new developments. Her informant reported that such is the success rate of this method that those recommended can be virtually assured of funds.

Pioneers

Early in this book we claimed two countries were pioneers of international containerisation. This is due to the developments achieved in only two countries. The USA and Australia. This claim recognises the generally acknowledged actions of Malcolm McLean and Matson Navigation as pioneers and translates this into a definition as recorded in the section "Definitions" Once this is done it is obvious that McIlwraith McEacharn in Australia satisfies this definition too. Each pioneer had sound reasons to choose the size and weight of their first containers and of course they were all different.

We have exact dates for the trial shipments of the McLean and Matson Containers, for McIlwraith we have only a year at present but others are searching and perhaps an exact date will be revealed. Even so the years show that whilst each pioneer worked and talked over the problem with others and they each benefited from this, each pioneer also worked at their own solution separately. What they did provided to the world a wide range of models that all worked brilliantly, all displayed the essential characteristics of future standardisation and each demonstrated the suitability of their own features for their own trade.

Never before has the world been provided with such a free demonstration of excellence, with the options laid out to view, together at the same time. For the pioneers the aims were all the same. They hoped to convert carriage of dry break bulk cargo to a profitable business.

Matson were the best placed to do this because they had ocean only trade with return freight guaranteed. Of course they had many competitors

varying from equal service to bilge quality opportunists. For them regular service and lower cost were clear winners.

For Malcolm McLean/Pan Pacific/Sealand the shipping was much more complicated. Some of it was coastal multi-port and vulnerable to rail and road completion and changing state laws and with a one direction bias. However Malcolm in his road fleet days had learned to work with these circumstances. For him his lower cost container operations looked a winner.

The McIlwraith McEacharn circumstances were critical. Find a way to reduce costs or get out of coastal shipping. Road and rail transport competed, freight was predominately one way and changing regulations a threat. Despite the manifest benefits of shipping, cost reduction was essential to survival.

The price and pain of fame

The world's final forced agreement to international containerisation standards had a variety of effects. Note the words "international standards". The initial issue was ISO 668 issued in 1970. This covered only container dimensions and ratings. During the next 20 years the standards issued have been supplemented by eight more and most have been revised. The three pioneers all suffered great cost. Each was forced to scrap their own containers and build fresh ones. Each was forced to order new ships and/or modify existing ones. Each was forced to scrap or modify existing handling equipment and order new equipment at immense cost. So those who provided the world with leadership, demonstrations and examples to choose from, all free, were deeply financially damaged for their trouble.

Well the world does not care. The BBC 4 program "The box that changed Britain" is a convincing example. It lists with excellent precision the changes to British dock workers, shows the English factories now empty of workers and rejoices the benefits bestowed on most British people including the unemployed. It states "the use of sea containers has made shipping so economical that it costs less to ship a TV from China to Felixstowe (UK) than it costs to deliver it from Felixstowe to the nearest English super market". This highlights the enormous benefits Sea Containerisation" has brought to the living standards of the world. The workers who made the TV have jobs and the TV is available to all, including those on welfare in the UK. It recognises the historic significance of what Malcolm McLean did, but that is all.

In 2016 the Scottish Port of Grangemouth issued a statement celebrating its history as the first container port in Britain. This was published on the 9 May 2016
"Grangemouth marks 50 years"

Grangemouth is Scotland's largest port and it berthed the first container vessel to visit the UK.

Sea-Land called at Grangemouth on Saturday, 7th May 1966 as part of its first Atlantic service, mainly to load Scotch whisky for onward travel to the USA.

Sea-Land launched the transatlantic container shipping service with four ships, each with an intake of 226 35 feet 8 feet high containers (then the maximum length for US trailers and the load height limit set by New York's Holland Tunnel).

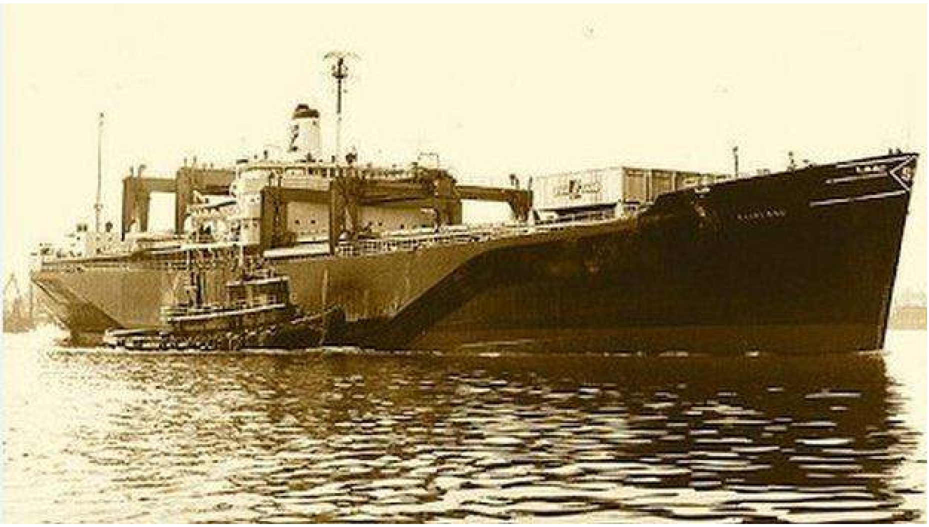

Image 42: Sea Land transatlantic container shipping service in 1966

The weekly service was the first transatlantic dedicated container service and called at Port Elizabeth, Baltimore Rotterdam, Bremen and Grangemouth, so Grangemouth was the first port in the UK to handle a dedicated containership, Rotterdam and Bremen were the first such ports on the Continent.

The archive picture sent out by Forth Ports shows the first container being offloaded. The text in the top RH says: 'Note the man standing on the gantry spreader as it is lowered by the shipboard gantry crane over the truck". This stevedore is the crane driver but not visible on this image.

Image 43: Sea Land container being offloaded to a truck in Grangemouth

The Sea Land ship had its own deck mounted gantry cranes to handle the containers. They were 35 ft Sealand containers not ISO units. This was 9 years after McIlwraith McEacharn shipped their first D boxes in Australia and Our assessment is that the service industry workers and public service

workers in developed countries have received great benefit and so have the productive factory workers in a few developing nations. First-world productive workers have fared badly. The International transport of shipped dry break bulk cargo has soared, only to fall now, a victim of what the former head of the US Reserve, Alan Greenspan called “over exuberance”

This history is about Australia and it is sad to report that our pioneers failed to save coastal shipping. It has become remnant. This has happened because the over whelming negotiating power of port worker and seaman unions, has raised shipping costs to the point where coastal shipping cannot compete with road and rail transport.

The total effects are much wider than just loss of coastal shipping. Sea carried imported goods are more expensive and exported goods are less profitable than they could be. Roads are much more heavily used and costly to maintain and construct due to the heavy use. Total employment varieties have been reduced and it is likely that total employment is also reduced. Even waterside worker labour numbers have been reduced by intense pressure to replace labour by the technology of automation.

Acknowledgments

Most of the pioneers who made this book possible are dead. However their contributions have been remembered by many who have been willing to find records and recall events to help the author tell their stories.

McIlwraith McEacharn, Seatainer Terminals Limited and Associated Steamship Limited veterans - David Owen, TSS(Tom) Stevens, Ed Ironside, and Graham Taylor and Capt. RC (Bob) Leggat. Tom Stevens provided a copy of the JHH Paterson Obituary. Ed Ironside provided a copy of the Adrian Boehme & Don Gillies paper

The Navy League of Australia - John Bird and Graham Harris (Federal President) Philip Corboy, Liz Sykes.

Shipping Australia Limited Phil Kelly Secretary Victorian State Committee.

Patrick Terminals Limited - Matt Hollamby, Russell Perry and David Hawkins.

Robert Reid and Associates - Bob Reid. Bob provided copies of the Stapleton articles published in the Port of Melbourne Quarterlies.

Port of Melbourne - Nick Easy and Leonora Curnick

Port of Fremantle - Steve Wade and Alan Pearce. Alan selected and later assisted the author to obtain permission to use a number of Port of Fremantle images.

The author acknowledges images of first quality provided by the Port that enhance this history and explain changes to cargo handing in a way that would not have been possible without them.

Descendants of Norman R Wright - Lisbethsusanne Brown, Dianna Bugden, Dianne Sinclair, Derek and Meredythe Taylor, Ian Wright.

Descendants of JF Callow - Roslyn Ford

R P Shannon - a special thank you for assistance with the final layout, order and proof reading, needed to make this history readable. He provided the conversion to Publication software lacking in the authors previous skills.

References.

Leonard Beadell OAM BEM FIEMS -1923 -1995. Surveyor and Author "Too long in the bush" Plus other stories.

Hans van Ham and Joan Rijsenbrij Authors "Development of Containerisation" ISBN 978-1-61499-146-5

Hugh Saunders. "Memories of Early Days in Container Shipping"

State public libraries of Queensland, South Australia, New South Wales.

Standards Australia. Container Standards. E34 and E39

http://www. matson.com – "A history of Matson"

Anthony J Mayo and Nitin Nohria. "The truck driver who Reinvented shipping". Malcolm P. Mclean 1914-2001

AC Boehme and DA Gillies C.Eng, M.I.Mar.E, A.M.R.I.N.A.- This is undated. It was presented to the IHCA probably in the 1970's

John F. Callow. "A search for Truth in Science" ISBN 0-646-32276-9

Ronald Parsons. "Southern Passages" ISBN 0949268674
Dewey 387.5099423

Lisbethsusanne Brown (nee Wright) "My father's Treasure"

Container handling ICHA paper

PORT FACILITIES AND HANDLING EQUIPMENT FOR CONTAINER CARGOES

A. C. Boehme and D. A. Gillies, C.Eng., M.I.Mar.E., A.M.R.I.N.A.

The paper briefly describes the types of container units in use in an Australian shipping operation and examines some of the specialized equipment which is used in handling these units.

A comparison is drawn between the principle of a trailer park type of terminal arrangement as distinct from a stacking area type of terminal and the economics are considered.

Finally, a method of attachment of containers to each other and to the deck of a container ship is described.

INTRODUCTION

At the present stage of rapid development of containerization, the evolution of specialized handling equipment is progressing at what may almost be described as an enormous rate. Therefore to adequately examine all the specialized container handling equipment presently available, even excluding equipment currently being developed is an undertaking certainly beyond the scope of this present paper.

The authors therefore wish to confine their remarks to Australian operations, equipment currently in use in Australia, and to further narrow the focus to encompass only equipment which is directly associated with the handling of container cargo in a marine operation, i.e., in ships and marine terminals.

AUSTRALIAN CONTAINER OPERATIONS

The principal ports served by Australian fully-containerized vessels are illustrated in Fig. 1, which also indicates the distances between these ports.

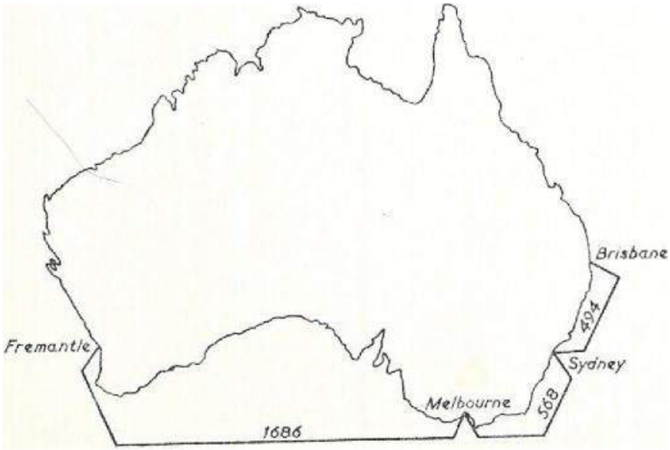

FIG. 1—Route of an Australian container operation

Australian coastal services provide a very comprehensive system of transportation with the services shown being provided by fully cellular container ships and other services such as those between the mainland and Tasmania and those between the southern states and Queensland being provided by combined roll-on/roll-off, Lift-on/lift-off vessels, having no cellular container capacity.

In the early planning stages of the Australian container services when the economics of several alternative systems were examined, particular attention was given to increased container throughput with minimum labour requirements, and also the speeding up of receiving and delivery, both of the full containers and loose cargo in the depots.

Basically the four terminal methods which can be used are:

1) a fork-lift stacking system;
2) a straddle carrier system;
3) a trailer park system;
4) a stacking terminal system.

In 1962/63 when the first terminals were being designed a decision was taken to develop what was then a unique method—the container stacking terminal. Brief comments on the four terminal systems follow.

Fork-lift Stacking System

Containers are lifted off trucks in the terminal by very large fork-lifts and pre-stowed, usually two-high by the same machines. When the ship is loading, the fork-lifts retrieve the containers from their position, load them on to a semi-trailer which takes them to the ship or gantry crane for lifting on board. The reverse applies for containers to be discharged. The disadvantages of this system are:

i) it is slow;
ii) large manoeuvring areas are required for the fork-lifts;
iii) both tine pockets and top lifting castings are required in the container, adding to its cost and reducing its cargo capacity;
iv) container damage is high;
v) terminal area is great with wide aisles and two-high stacking;
vi) the pavement over which fork-lifts operate is expensive and, in many cases, needs to be piled to accommodate the very high axle and wheel loadings;
vii) fork-lift drivers have limited visibility.

Straddle Carrier System

This system is similar to that of the fork-lift terminal but without some of its disadvantages. Straddle carriers have smaller wheel loadings and are more manoeuvrable. The drivers have greater visibility than fork-lift drivers. Large paved terminal areas are, however, still required as containers can only be stacked two-high and some space has to be left for the vehicles themselves.

Straddle carriers can eliminate the use of an intermediate transit vehicle from stack to ship, provided the distance is quite small, but the straddle carrier at some $A80,000 capital cost is an expensive piece of equipment for this horizontal transport task. Generally speaking, the straddle carrier terminal operation is a compromise between the trailer park and stacking terminal concepts and is, in fact, suitable—in Australian terms—for cargo volumes of between 15 000 and 50 000 containers per annum.

Trailer Park Terminal System

This is the simplest terminal system in concept. Containers are discharged from the ship directly onto a trailer from which they are not removed throughout the whole of the cycle of transport, unpacking, checking and re-packing, then return to the ship. When the newly packed container re-enters the terminal it is allocated a parking position which corresponds to its designated stowage position in the ship and in due course a prime mover connects to it and tows it under the loading crane. The number of semi-trailers is approximately equivalent to the number of containers to be discharged from a ship at any one time. Large areas of land are required for marshalling areas and parks, all of which have to be paved but only to road strength requirements.

The greatest disadvantage is the high capital investment in semi-trailers—some $A4500 each in Australia—and the very considerable cost of providing the area of land required for such a terminal in the high-value port area.

Container Stacking Terminals

Under this system the ship or shore-based discharging crane lands containers onto an internal transfer vehicle which conveys them into the terminal where they are lifted off the vehicle by an overhead bridge crane and placed into a predetermined position in the stacking terminal. The overhead bridge crane then replaces a container, or containers, onto the internal transfer vehicle which returns to the ship or shore-based crane to load them into the ship.

Containers are stacked up to five-high with approximately one ft in each direction between them. This makes for a very compact terminal area, but it does mean that a substantial pavement, usually piled, is required to support the heavy point loadings at the container corners. In addition the pillars which support the overhead travelling crane rails must withstand heavy dynamic loadings.

Because of the compact nature of this type of terminal it can be located close to the ship's side, and relatively small distances are involved in the movement of containers from their terminal position to the ship's side and vice versa. Thus, inherently, this system requires a smaller labour content and is easier to programme, supervise, control and, if necessary, automate.

The advantages of such a terminal are:

a) smaller land area is required than for any of the other terminals;
b) lower capital cost is involved;
c) a smaller labour force is required.

Against this, there is the disadvantage of some containers being not immediately available if required for urgent delivery to consignees, and therefore a certain amount of re-handling of containers is necessary during the delivery phase.

One of the difficulties normally associated with the introduction of containerization is the alleged requirement for substantial areas of land in the environs of a major port for the main container handling terminal. Using the stacking terminal system, however, it is possible to put up to seven times the volume of containerized cargo through, say, a twenty acre site, than would be possible with conventional cargo. In fact, it is the authors' belief that the space occupied by a conventional berth, with its wharf sheds and associated road and rail connexion systems, is adequate to provide a container ship terminal to handle between 600 000 and 800 000 tons of cargo per annum.

Australian Terminals

Since 1964 the authors' company has operated stacking terminals in Melbourne and Fremantle, but during 1968 these terminals were expanded and became part of the network being established by Seatainer Terminals Ltd. to handle the greatly increased volume of Australian coastal and international cargo, arising out of the greatly expanded services to commence in 1969.

Stacking terminals have been constructed in Fremantle, Melbourne and Sydney, whilst a straddle carrier terminal has been established in Brisbane. These terminals will provide the facilities for Australian, British, European and Japanese container ships, and are expected to be handling some 300 000 20-ft containers per annum by 1970.

The Swanson Dock Terminal being built in Melbourne is typical of the Australian pattern of stacking terminals, and is situated within four miles of the heart of that city on a newly dredged dock off the Yarra River. The Melbourne Harbour Trust have provided both berth and wharf, whilst Seatainer Terminals Ltd. have provided cranes, terminal buildings, roads and all other facilities.

The development of this terminal is taking place in two phases, the first of which has been completed, and the second of which is expected to be completed towards the end of 1969. In Phase I over A$4 million have already been spent by Seatainer Terminals Ltd. and a slightly lesser amount by the Melbourne Harbour Trust. This covers the provision of the berth, a twin lift 45-ton wharf container handling crane; two 45-ton twin lift electric overhead travelling cranes in the terminal itself; capacity to store approximately 1350 20-ft containers in the terminal at any one time; an ability to handle up to 20 000 tons of general cargo per day through the one wharf crane and the expectation of being able to handle up to 125 000 20-ft containers per annum in the Phase 1 configuration.

Phase II involves the addition of a second twin lift 45-ton wharf crane and a third electric overhead travelling crane of similar capacity, with an extension of pavement, building roads, etc. to accommodate additional volume. These extensions will lift the capacity of the terminal by approximately 50 per cent and provide a handling ability in excess of 3 000 000 tons of cargo per annum, with less than 50 per cent of berth occupancy.

Central to the whole system is the twin-lift capacity of the cranes enabling two 20-ft containers to be handled concurrently at all stages throughout the system. Considerable handling and ship time savings have resulted from the introduction of the twin-lift concept—pioneered by the authors' company—and not only have significant labour savings been achieved, but capital expenditure per container handled has been substantially reduced. A container wharf crane of the standard single-lift 25-ton variety costs approximately $A700,000, whilst the twin-lift 45-ton wharf crane costs approximately $A900,000; each requires one driver. Internal transfer vehicles and terminal cranes are also on the twin-lift principle and therefore the

productivity of the labour is greatly increased throughout. A single twin-lift crane can be expected to handle containers at between 166 and 175 per cent of the speed of a single-lift crane.

In order to obtain proper benefits from the twin-lift principle it is, of course, necessary to concentrate on very careful design, not only in the crane and the spreaders, but also of the ships and the terminal lay-out.

The Melbourne container terminal is situated on relatively poor land from the building point of view and is supported on some 2760 concrete friction piles, each approximately 90-ft in length. The corners of the containers are supported by the pile caps, each of which is designed to support a loading of 125 tons.

Refrigerated containers to be used in the coastal and Japanese services will have their own integrated refrigerated units and will need only to be plugged in to the power supplied in the terminals. The units to be used in the United Kingdom trade, however, are insulated boxes into which air at the appropriate temperature and humidity is pumped from a centralized system on board the ship, and a matching system, complete with cell guides, is provided in the terminal.

A refrigeration plant has been installed in the Melbourne terminal, from which 240 containers of refrigerated cargo can be held under refrigeration until required for loading to a vessel, or, after being received from a vessel for delivery to a consignee. A central plant room supplies freeze and chill brine through an extensive pipe system to brine/air coolers. These coolers arc located on the access platforms between the ends of containers, and each cooler serves five containers through vertical duct work, with forced air circulation. The primary refrigerant is Freon 22, the secondary coolant is calcium chloride brine, thereafter air which is circulated within the container. The air system re-circulates through any number of containers up to five per cooler unit.

Automatic couplings are fitted to connect the container to the air duct, and these are operated from central control panels at ground level, each panel controlling 30 containers. The cell guide structure has been sealed to full

height to divide total stacking area into four completely sealed sections of 60 containers each thus providing barriers against cross-taint between containers with cargo liable to taint.

TYPES OF CONTAINER IN USE

Dry Cargo Containers

i) In 1963 construction of an unprecedented number of containers was commenced, and these units were to be used in conjunction with Australia's first fully-containerized vessel—*M.V. Kooringa*.

The *Kooringa* operation was complicated by the necessity to carry units of two different widths 2438 mm (8 ft 0 in) and 1829 mm (6ft 0 in). The 6-ft wide unit is a very popular sized container for Australian coastal purposes being of 120 ft^3 capacity and having dimensions of 1829 mm (6 ft 0 in) wide, 1257 mm (4 ft 11 in) deep and 1829 mm (6 ft 0 in) overall height, with an all-up weight of 3 tons (3042 kg), carried on two hardwood bearers permanently attached to the underside of the floor. These units are of light-gauge sheet steel construction and have a tare weight of approximately 381 kg (840 lb). There are approximately 6600 of these units currently in use around Australia in the operations with which the authors' company is associated. These containers formed the subject of an Australian Standard No. AS E39-1965 and are still included in current container planning, and provision has been made for their inclusion in the two new Australian container ships under construction at Whyalla, South Australia.

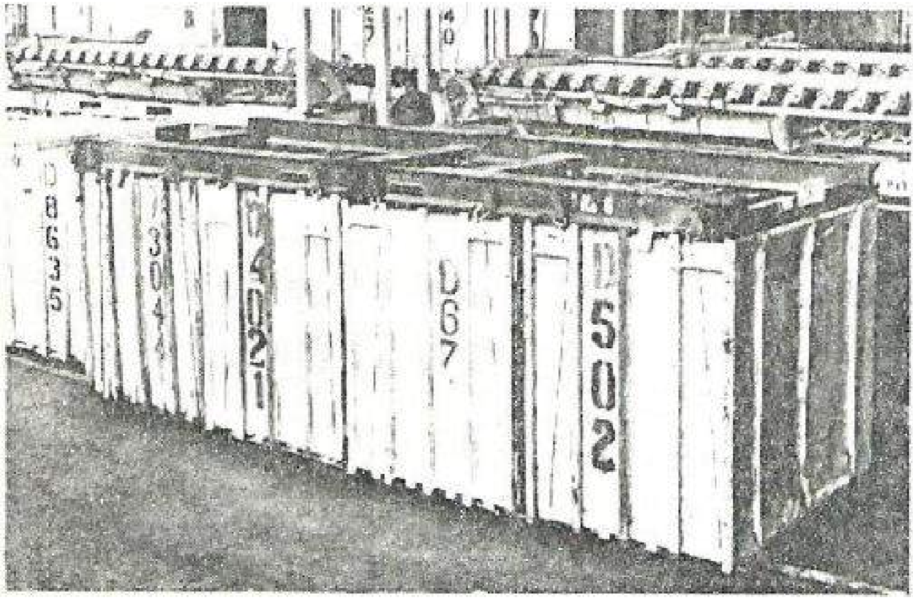

Fig 2 – "D" type container

An illustration of the 120 ft^3 "D" type Australian Container is shown in Fig. 2 in a group of four units latched to a lifting frame, which remains attached to the four units and restrains them against lateral movement while in the ship. This configuration has been used prior to the introduction of the "10D" unit which, as its name implies, consists of ten 120 ft^3 units latched to a lifting frame.

ii) The original Australian Standard large freight container had the dimensions: 5080 mm (16 ft 8 in), long, 2438 mm (8 ft 0 in) wide and 2591 mm (8 ft 6 in) high, but with the acceptance of the International Standards Organization standard for large freight containers by Australia in 1968 operators handling large numbers of containers particularly in an integrated system had no option but to change over to the ISO sizes. The most widely acceptable of these was the 1C type having dimensions 6058 mm (19 ft 10½ in) long, 2438 mm (8 ft 0 in) wide and 2438 mm or 2591 mm (8 ft 6 in) high as shown in Fig. 3.

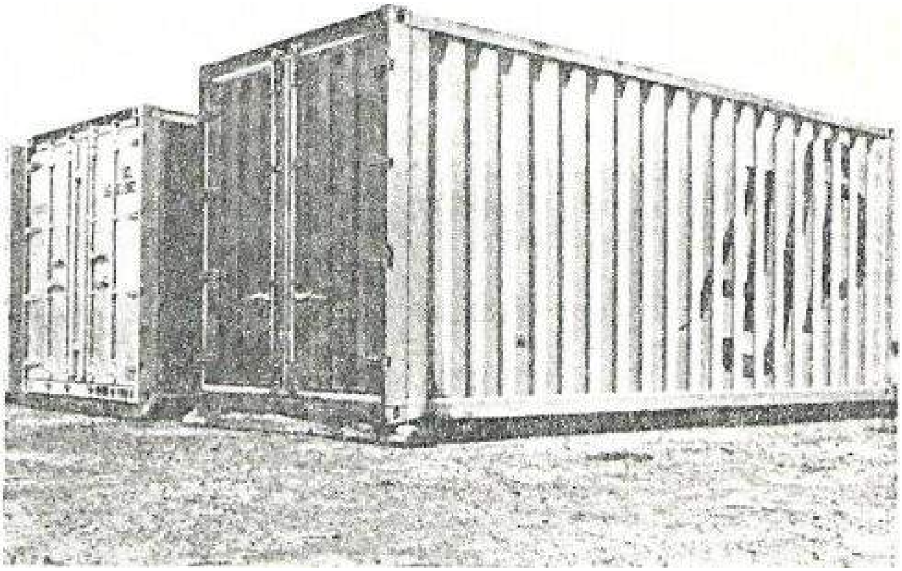

Fig 3 – "IC" type container

One basic design of this unit revolves around an alloy steel, fully-welded frame built-up from formed plate sections. The side panels are of 16 gauge sheet alloy steel having zig-zag corrugations, the material in each case having approximately the following chemical and physical characteristics:

Carbon	0.09-0.12 per cent
Phosphorous	0.085-0.12 per cent
Manganese	0.75-0.95 per cent
Silicon	0-40-0.60 per cent
Sulphur	0.02-0.04 per cent
Copper	0.15-0.35 per cent
Chromium	0-50-0.70 per cent
Nickel	0.20-0.30 per cent
Yield Strength	50 000 Ib/lin^2 minimum
Tensile Strength	70 000 Ib/in^2 minimum
Elongation in 2-in	22 per cent minimum

Both upper and lower corner castings are of cast steel to B.S.S. 3100 and of ISO configuration except that the chamfer on the locating hole edge has been increased to s in x 45' from the ISO-1 in x 45°.

iii) In addition to the ISO 1C type unit, Australian container operations called for a unit suitable for the carriage of rougher type cargoes such as 45-gallon drums, pig-iron, plough shares and similar items not requiring protection from the weather during transit, and possessing large weight/space ratios. For this type of cargo the "half-height open-top" unit was developed having the same dimensions in plan as the ISO 1C unit, but being only 1295 mm (4 ft 3 in) high and without any roof. A similar construction is employed as in the 1C type and the similarity is noticeable from a comparison of Figs. 3 and 4.

iv) Supplementing the foregoing units a further type of container has been found necessary, and this is known as a "sea-pallet" because it has portable wire-mesh sides and consists fundamentally of a base and two ends, which may be either fixed or collapsible as required. Fig. 5 shows a general view of such a unit, the overall dimensions of which are 6058 mm (19 ft l0 in) long, 2438 mm (8 ft 0 in) wide, and 1930 mm (6 ft 4 in) high. A reasonable degree of freedom must be available to permit the spacer to locate into the square openings provided in the spreaders for each leg, and the "gather" or clearance assisting this function may be observed in the illustration.

Another vital requirement is that of providing adjustment of the distance between the two adjacent ends of the containers being "twin-lifted", since this distance varies with the details of ship's cellular structure or the requirements of terminal stacking. Variation of spacing between containers is effected by altering the position of the flat plate containing the holes for locating the spacer legs. One of these plates is mounted in slides on the top of each spreader and its position adjusted by means of hydraulic cylinders controlled from the crane driver's cabin, the sliding plates on both spreaders moving in concert either towards or apart from each other thus altering the spacing between the two spreaders or containers.

So far, only the lifting of ISO standard sized container units has been considered, but as mentioned previously, Australian operations are complicated by the need to handle much smaller units, involving not only a

different cellular guidance system in ship or terminal, but also different spreaders and methods of lifting. To handle the standard Australian 120 ft^3 unit previously described, a method of lifting was devised which consisted essentially of a lifting frame to which ten containers could be attached manually by their lifting rings, and the whole assembly lifted by means of a single 6 ft 0 in wide spreader. Fig. 7 shows the salient features of the lifting frame which is approximately 41 ft 8 in long. The complete frame together with ten "D" type containers is lowered into the appropriate cell and the frame remains attached to the containers, providing support for the next tier above, which is lowered onto the frame below so that the wooden bearers on the base of the containers "nest" between the longitudinal side members of the frame. Total weight of ten "D" type units and lifting frame is approximately 32 long tons, therefore the capacity of the shore cranes to handle these units must be at least 32 long tons excluding the weight of spreader, blocks etc.

Locating and Locking

The most critical areas for correct location and locking of containers are the hatch covers of a container ship, which will, in the course of loading assume angular attitudes relative to the base plane of the container units themselves, due to either list or trim of the ship, or a combination of both.

Fixed guide plates may be strategically arranged on the hatch covers in way of the outer corners of a pair of containers to provide some guidance onto the locating fittings. However, to locate subsequent pairs of containers, it is necessary to locate the second pair against the sides of the first pair, and then lower the second pair down onto the locating fittings. Spacing between the sides of adjacent containers is therefore approximately 1 in – 1½ in.

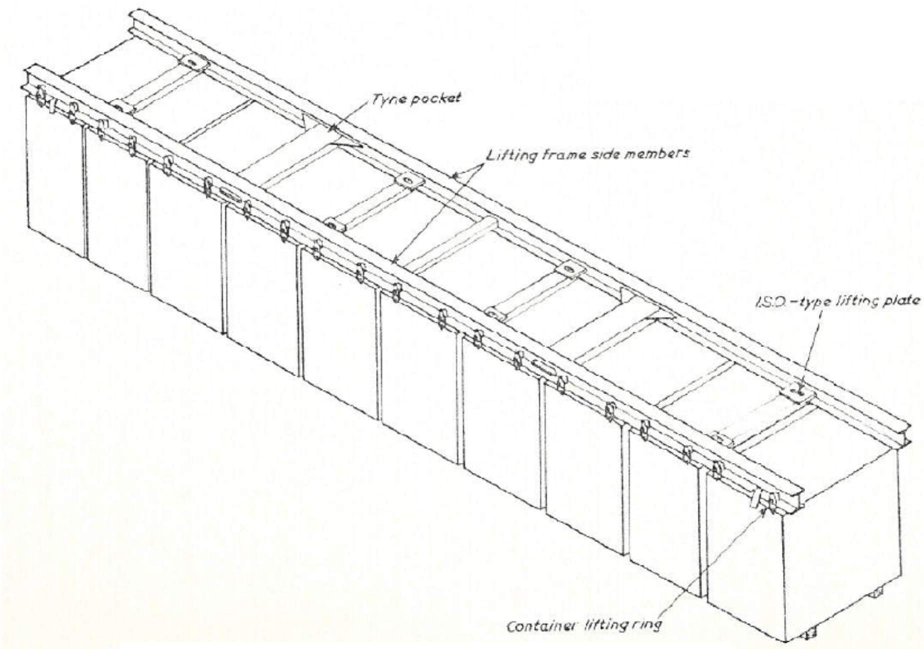

Fig 7. Frame for lifting ten "D" type containers

The authors' company has devised a cast steel or S.G. iron locating fitting which may be used for the dual purpose of locating containers either on hatch covers or on top of other container units. The insertion of a 25 mm (1 in) diameter steel locking pin serves to lock the units either to hatch covers or to each other. Fig. 8 shows an exploded view of this "double-male stacking fitting" in relation to two container corner castings The attachment of containers to hatch covers is simply effected by dropping the required number of double-male stacking fittings into locating holes profiled into the fabricated container mountings attached to the hatch covers. These holes are identical to the lifting openings in the upper corner casting of a container.

After correct location of the container on the flange of the fitting, it is secured by the manual insertion of the locking pin shown in Fig. 8 which when turned through 90°, as indicated by the position of the handle, is unable to be accidentally dislodged.

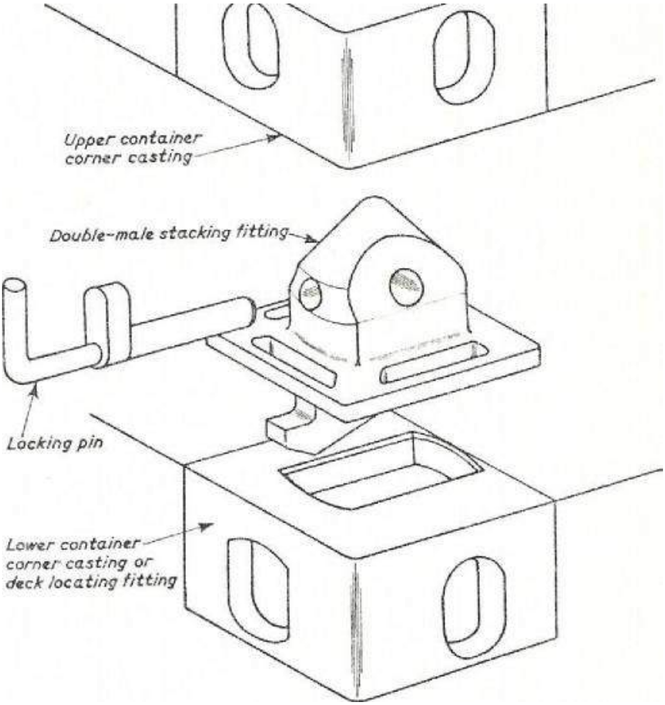

Fig 8: Double-male stacking fitting

Containers attached to the hatch covers by a similar method to that described have been carried between Melbourne and Fremantle, a distance of about 1700 nautical miles, for over four years in M.V. *Kooringa* Fig. 9. The low freeboard of this vessel with consequent comparative close proximity of deck containers to the sea will be obvious.

During this period, a total of several months of very bad weather has been experienced. Usually the bad weather is encountered when proceeding west and takes the form of long westerly swells accompanied by winds varying between Force 8 and 9 on the Beaufort scale.

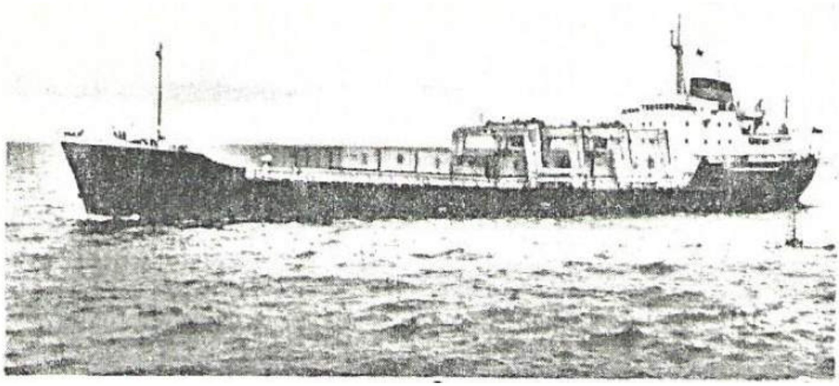

Fig 9: m.v. Kooringa

Fig. 10 illustrates the type of head weather often experienced and Figs 11 and 12 depict the effects on the forward ends of containers mounted on the foredeck hatches during one particular westerly crossing during the winter. It should, however, be noted, that despite severe damage to container end panels and contents, the frames are still securely attached to the hatch covers by the locking pins which were not damaged.

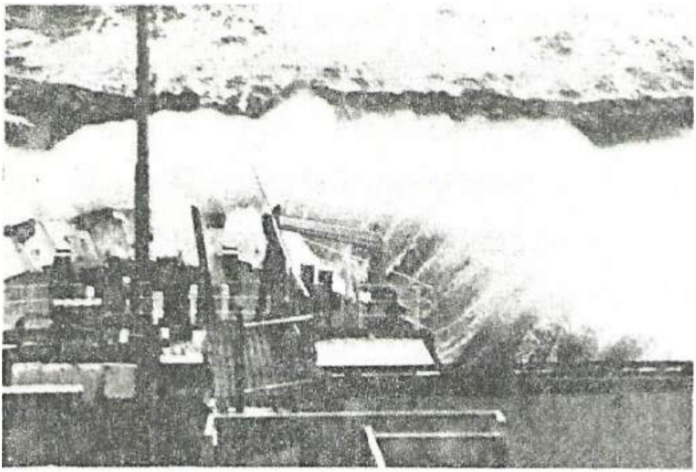

Fig 10: Deck containers exposed to head weather

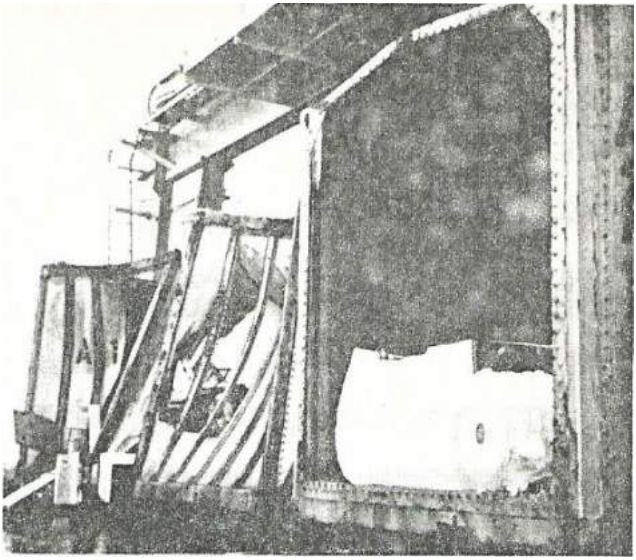

Fig 11: Effect of head weather on containers mounted on foredeck hatches

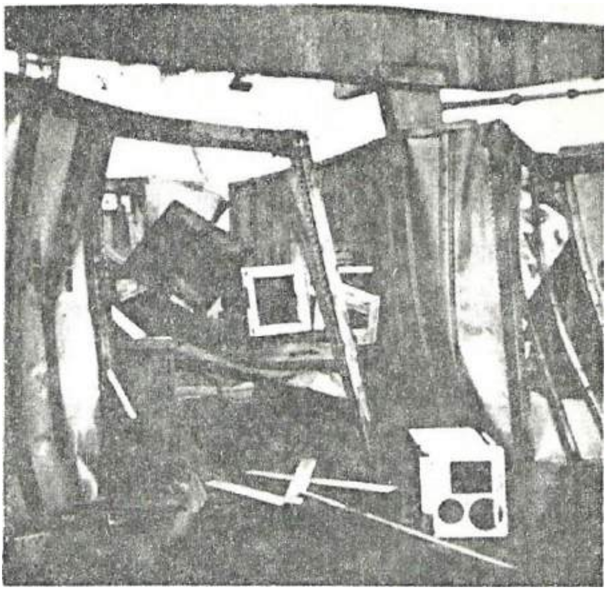

Fig 12

The foregoing method of attachment of containers to a ship's hatch covers, has also proved satisfactory for attaching a second tier of units to the first tier without the necessity of using additional heavy and cumbersome lashings to resist tangential shearing forces imposed on the deck containers by virtue of the rolling motions of the ship in a seaway.

For the basic design of the cellular guidance system in the hold of a container ship, calculation of the dynamic forces due to roll and pitch are necessary. The tangential force due to rolling is given by:

$$\text{Tangential force} \quad F_T = \frac{W}{g} \; x \; L \; x \; \theta \; x \; \frac{4\,\pi^2}{T^2}$$

Where W = Gross container weight, tones
L = Distance between transverse C.G. of ship and C.G. of container, feet
θ = Maximum angle of roll, radians
T = Period of roll of ship, seconds
g = Acceleration due to gravity – 32.2 ft/sec^2

This equation reduces to:

$$F_T = \frac{1.225\,WL\,\theta}{T^2}$$

If the effects of heaving and pitching are disregarded, since these forces are frequently out of phase, the resultant force normal to the cell guide face is given by:

$$F_N = W\;Sin\;\theta + F_T\;Cos\;\varphi$$

An extension of this method may be used for estimating the shearing load between the sliding surfaces of two tiers of containers mounted on hatch covers as illustrated in Fig. 13 and from this value, some idea as to the extent to which the lower unit will "parallelogram" due to the inertia of the upper one.

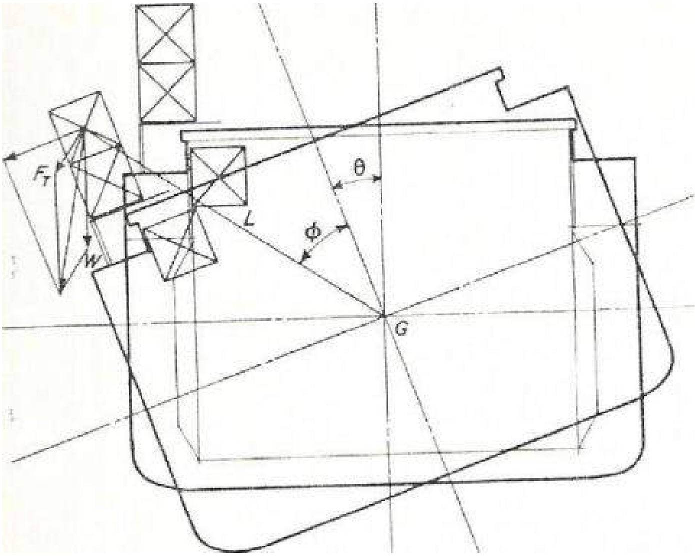

Fig 13: Simplified diagram of forces on container due to rolling motion

Where a container is mounted either well forward or well aft, and the accelerations due to heaving and pitching are coincident with the rolling acceleration, then the maximum resultant transverse force may be found from:

$$F_{Tm} = (W + F_H + F_{PT})\ Sin\ \varphi + F_{RN}\ Sin\ \varphi + F_T\ Cos\ \varphi$$

Where FH = Force due to heave
FPT = Force due to pitch
FRN = Normal rolling acceleration force, given by

$$F_{RN} = \frac{1.225\ W\ L\ \varphi^2}{T^2}$$

Based on the foregoing, the magnitude of the transverse rolling forces imposed on the extreme outermost container of 22.5 tons gross weight, and mounted on deck of a typical unstabilised vessel of about 480 feet long between perpendiculars, 72 feet beam, and 24 feet draught, in a seaway and having a natural period of roll of 13.6 sec, rolling about 35° port to starboard

is about 9 tons. However, it is apparent that in the event of the heaving and pitching accelerations coinciding with the rolling accelerations, a total shearing force between first and second tier containers of about 0.88W may be experienced.

Applied to the latest Australian container ships, this is an extreme example, particularly as new container ships are probably equipped with an effective system of stabilization. Even so, Australian standard containers, 8 ft 6 in high, built to the requirements of the Commonwealth Department of Shipping and Transport must be subjected to a racking test load of 25.0 tons without suffering appreciable permanent deformation. No difficulty is experienced in meeting this requirement, which is equivalent to Lloyd's comparable test, if the containers are of all-steel construction, as described earlier. A considerable saving is thereby obtained by the elimination of deck lashing equipment, which involves both capital and subsequent recurring handling costs. A further reason for avoidance of deck lashings if at all possible, is the adverse effect of this equipment when considering the important matter of initial manning.

ACKNOWLEDGEMENTS

The authors wish to express appreciation to the management of Associated Steamships Pty. Ltd. for permission to publish the information contained in this paper, also to Vickers Hoskins Pty. Ltd., of Western Australia and Seatainer Terminals Ltd., for assistance in its preparation.

BIBLIOGRAPHY

HARLANDER, L. A. 1960. "Engineering Development of a Container System for the West Coast-Hawaiian Trade" Trans. S.N.A.M.E. Vol. 68, p. 1052.

HARLANDER, L. A. 1961. "Further Developments of a Container System for the West Coast-Hawaiian Trade". Trans. S.N.A.M.E. Vol. 69, p. 5.

MCMULLEN, J. J. 1962. "Ship Design Aspects of Containerization" University of California, May.

HENRY, J. J. and KARSCX H. J. 1966. "Container Ships". Trans. S.N.A.M.E. Vol. 74, p. 305.

ARGYRIADIS, D. A. 1959. "Cargo Container Ships". Trans. R.I.N.A. Vol. 101, p. 297.

GILLIES, D. A. 1967. "The Development of Containerization" I.Mar.E. Victorian Branch *Newsletter* No. 2 July-Sept. et seq.

Discussion

LIEUTENANT-COMMANDER A. N. S. BURNETT, R.N. (Member, I.Mar.E.) asked what in the authors' experience was the size of the problem of goods being stolen from containers, both in the park and elsewhere? Was it still a problem? The paper referred to the refrigerated containers and mentioned the various types. He understood the meaning of types 1 and 2—each container had refrigerating machinery clipped on. It seemed that some of the advantages of standard shapes would be lost in transportation functions, stacking, etc. Some American operators used this type of refrigerated container; he had seen them in San Francisco with the refrigerating machinery added on to the out-ide of the container, making inland transportation a little more difficult. A.C.T. and O.C.T. in their new ships used a different method in that the standard container shape was connected to cool air ducts on board which kept the container contents in good condition. Could the authors comment further?

Dealing with the question of steel, as opposed to aluminium, containers, presumably there was a difference of cost between the two types. What was the justification in having all-steel containers?

MR. E. A. BROWN (Member, I.Mar.E.) said that, at Lloyd's Register of Shipping, he had been involved over the past two years with containers and their certification. The authors had not mentioned tank containers. Lloyd's Register were drafting tank container requirements and were receiving queries, particularly from Australia, dealing with requirements for such containers. What sort of problems had been encountered in Australia and what steps were being taken towards the acceptance of certification by Lloyd's Register of containers owned by the big companies like O.C.L. and A.C.T.?

At docks and container ports he had noticed a certain amount of damage to containers in use. Lloyd's Register had had to devise a scheme for re-certifying damaged containers. The extent of the damage governed whether or not they were certifiable once again and this meant detailed investigation and examination, also possible re-testing. It was becoming evident, particularly with the refrigerated type, that the superficial damage due to handling in transit reduced the effective life of these containers and, as the construction was largely not steel, the damage sustained was more marked than that of other types. Were there similar problems experienced in Australia?

MR. P. R. SALISBURY, B.Sc. (Member, I.Mar.E.), referring to the comparison of the various methods for moving containers after discharge from ship, said that there was another method of moving containers from the vicinity of the ship, storing and stacking them, utilizing conveyor and stacking equipment similar to that used in garages for parking cars. The containers could thus be kept at one location. This was economical in ground space and lent itself to sorting containers before they went to their final destination, particularly important where train loads were to be made up because shunting was eliminated. It might be that in Australia the majority of containers were conveyed by road trailers. The British system was made by Vickers and was known in America as the Kaiser speed-park system. Had the authors considered this system obviously requiring less labour? When sorting became a problem, it could be adapted to computer control while the present system relied upon men driving tractors.

The authors gave no indication as to why the point had been made about the steel used in containers, but Mr. Thompson who presented the paper had referred to it as being anti-corrosion or corrosion-proof steel. That might be the answer to Lieutenant Commander Burnett's question about why an aluminium-alloy container was not adopted. If it was corrosion-proof steel, had it been found necessary to put any protective coating upon it?

MR. E. F. SIMMONDS said that of A$700,000 for the conventional container handling crane and A$900 000 for the twin lift crane had been mentioned. Was the latter considered a high price and where was the crane

manufactured? It had been said that the company was responsible for developing the twin lift principle. Could the authors enlarge upon it?

Authors' Reply

In reply to Lieutenant Commander Burnett who enquired as to the size of the problem of goods being stolen from containers, the authors said the extent of this problem had been considerably reduced, in fact so much so that their company provided shippers with a free insurance cover between certain ports as an added incentive to containerize their cargoes. Pillage of such commodities as chocolates and liquor still occurred but areas where it took place had been isolated to two possibilities—at the shipper's warehouse or depot where the cargo was packed, or in transit by road to terminal. The extent of pillage was now considered a minor matter.

On the question of clip-on refrigerating units, the only major difficulty encountered in transit was the supply of the correct electric current required. The use of these units gave the advantage of no serious reduction of cubic capacity in a large number of containers and also permitted the same containers to be carried below decks in the specially designed cells equipped with retracting cold-air connexions coupled to the ship's fixed cargo refrigeration system. Containers fitted with clip-on units might also he satisfactorily carried on deck in containerships in quite large numbers provided the ship was fitted with the necessary power outlets. Very few difficulties with these units had arisen either on board ship or during road transport. In Australia, the power required was usually 415 V 50 cycles, 3-phase current.

Lieutenant Commander Burnett was correct in his assumption that there was a difference in cost between the composite steel/aluminium container and the all-steel unit. Assuming the all-steel unit to be of the type described in the paper, the difference in cost was a 31 per cent reduction in favour of the all-steel container. If any further justification was required, the authors believed the steel unit cheaper to repair than the composite unit.

Answering Mr. Brown on the question of experience with tank-type containers they said while a few containers of this type had been carried in

Australian containerships, their use has so far been limited to the carriage of glucose and high specific gravity, high viscosity substances. Some units had consisted simply of an "L" type (19 ft 10½ in x 8 ft 10 in x 4 ft 3 in) closed at the top and fitted with a steam jacket at the bottom for connecting up after delivery, and means for filling and emptying the cargo.

A few units had been constructed consisting of an elliptical section stainless steel tank similar to a conventional liquid road tanker, simply mounted inside the frame of a normal "K" type container (19ft 10½ in x 8 ft 0 in x 8 ft 6in).

In the authors' experience no problems of any magnitude had been encountered, but the number of tank units in service was very small. As far as they were aware no attempt had yet been made by any regulatory body in Australia to formulate requirements for tank containers. The task would be a difficult one due to the variety of liquids which might be carried in this manner. Certainly extreme care would be required in the design and construction of a unit involving the carriage of corrosive or dangerous chemicals under pressure. The carriage of such liquids appeared to be adequately provided for by the present method of loading a number of pressure cylinders into a normal open-type container carried either on deck or in the hold especially fitted for the carriage of inflammables or low-flash point substances.

Mr. Brown had referred to a difficult matter when he spoke of the re-certification of damaged containers after repair. Because of large numbers of containers in circulation in the operation with which the authors were concerned, a special container repair facility had to be established in addition to a computer-assisted recording system to keep track of the units and to report on their condition. It was the objective of the "container pool" to inspect every unit once in twelve months and to then carry out minor repairs or painting as required. Where any structural damage was sustained, the cost of repair was assessed and weighed against remaining container economic life, and, if economically justified, the unit was repaired, re-tested as necessary and re-certified. The certificate issued was that required by the Australian Navigation Act. For the guidance of those responsible for the repair of steel units of special alloy steels, an instruction manual had been

prepared describing the method of construction, type of welding rods to be used, etc. Included was guidance regarding the structural strength members, repair of which would necessitate retesting and re-certification.

As far as damage to refrigerated units was concerned, the authors' company had had a small number of these in continuous use for over five years without sustaining significant damage. These units had steel frames and aluminium side, end and roof panels. The insulation consisted of foamed-in-place polyurethane which assisted considerably in supporting the wall-panels against superficial damage. Perhaps it was a little early yet to distinguish a pattern of damage which could be described as peculiar to refrigerated units as distinct from dry containers.

The system of container storage referred to by Mr. Salisbury was one of which the authors had some knowledge but no experience. This system was a highly-sophisticated one certainly requiring complete computer control of the functions of selection and transfer of the units. He was correct when he supposed that most of the containers moved in Australia were moved by road rather than rail, although rail tracks were provided through the new cargo terminals built in Australia. Such a system as he mentioned had been considered but the capital cost was greater than the system finally selected. The possibility of programming the movements of containers in the present type of terminal had not been overlooked, and if future requirements dictated, the computer control of existing overhead travelling cranes and internal transport vehicles (I.T.V's) would undoubtedly follow. The labour content of existing terminals for purely positioning containers was minimal even without adding any further electronic hardware.

Replying to the point made by Mr. Salisbury that the reasons underlying the selection of a nickel-alloy steel for the latest series of containers had perhaps not been fully explained, they said, the general parameters for design of a container could be summarized as maximum strength coupled with minimum weight and good corrosion resistance, for the least cost.

On the question of strength, the main structural frame members were required to be of steel to withstand the forces imposed in testing and subsequent operation. If this steel could possess some corrosion-resistant

(unhappily not corrosion-proof) properties so much the better. For this application the local equivalent of a Corten-type steel was selected. From the authors' experience with aluminium side panels having steel stiffeners, it had been found that there were certain damage conditions for which it was just not possible to provide in the design, for example, the side panels being inadvertently punctured with the tynes of a fork-lift truck. Whether the panel was manufactured of steel or aluminium made little difference under such conditions. The problem was to find a panel which was cheapest, easiest to repair, strong enough for service conditions and still was as corrosion-resistant as the main structural members. After considerable investigation, a light-gauge corrugated panel of the same material as the main structural members emerged as the answer to the problem. To further inhibit corrosion and for the sake of appearance it was decided to coat the units internally and externally with a zinc-rich coating and this necessitated shot-blasting all the steel in the units to grey-metal finish prior to the application of the zinc by airless spray.

The end result was a unit which, as already stated, had a lower capital cost, was stronger and had a lower maintenance cost than a similar composite-type unit.

In reply to Mr. Simmonds the authors felt the capital cost figures quoted in the paper for the Portainer cranes were not high when speaking in terms of this type of equipment. The term "high price" used by Mr. Simmonds was purely relative, and in some contexts the figures quoted would certainly be regarded as "too high". When compared with the capital cost of say two container ships, several hundred containers and associated terminal facilities, these figures become relatively not so high.

The Portainer cranes used in Australia were of two designs, one an American design built in Western Australia, and the other a Swedish design. One of each of these cranes was in operation at the White Bay Terminal in Sydney. Both cranes were designed for lifting two containers simultaneously on the twin-lift principle.

As mentioned in the paper, twin-lifting was simply the lifting -or handling- of two containers simultaneously by means of two spreaders which suspended

the containers end-to-end. They must be also restrained within certain limits so that they might readily enter the guidance system in the ship, but at the same time be capable of complete separation for independent progress into adjacent cells.

This restraint and subsequent separation was affected by means of the "spacer" which held the two spreaders and containers at the required distance apart. Reference to Fig. 6 of the paper might serve to illustrate this point, or to Fig. 14 showing two containers being twin-lifted.

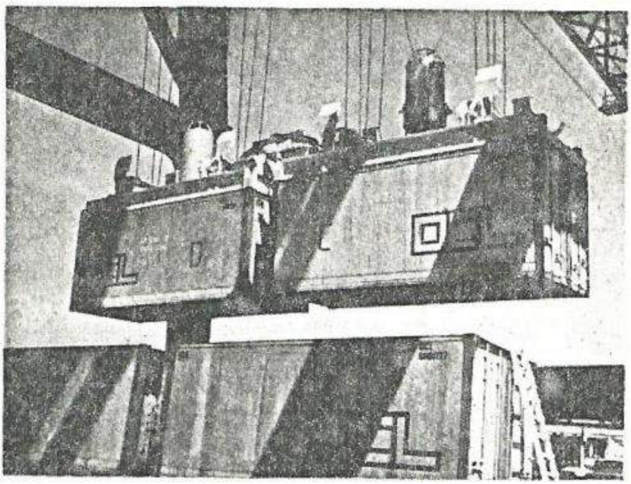

Fig 14

My Dad's Hidden Treasure

Lisbethsusanne Brown (nee Wright). "My Dad's Hidden Treasure"

My Parents had four children under the age of five before, as dad put it, they worked out the cause of the problem. Dad worked as a manufacturing engineer, and just after the war managed to become foreman (the second boss) to the owner of the factory where he worked. Both Mum and Dad were hard workers. When the old man who was boss died suddenly a few years later, they had managed to get enough money together to buy the whole factory. The son of the proprietor did not want the business and sold it on behalf of his mother. It must have been an exceptionally sad time for all the workers and the old lady because the sale included the house the old couple had lived in.

This is why we moved house when I was five. I can remember being thrown high into the enclosed truck and landing on the mattresses all piled high on top of tables chairs cupboards and lounges. My sisters, Merydyth and Dianna were thrown up as well. It was a great adventure, even a little scary, as the big doors were closed and it became very dark, but gradually our eyes could see again. Then with Mum and Dad and our baby brother in the front cabin the truck moved us all to the new house. As the truck drove we went over bumps and railway lines and each time the mattresses moved swaying this way and that, we sang out, "I hope we don't go over another bump !" and when we did we all squealed with excitement.

The house was an old federation type with large oval windows, a tiled verandah and a long hallway with archways and doors leading to bedrooms. There was a kitchen, lounge, dining room and a bathroom at the back. It was a great place for hide and seek and for finding boxes of old collections like

hundreds of old cards, or flags from around the world, or lace hankies which we carefully shared with each other, only to have Mum confiscate all our treasures and put them back in the boxes neat and tidy.

One rainy day we were playing hide and seek and this time I sneaked into mum and dad's bedroom. I had discovered I stayed hidden longer if I found a higher hiding spot, better than under a bed, but all of the cupboards in our bedrooms had been used. Mum and Dad's bedroom cupboards were much taller than our smaller ones, and had an ornate carved lip at the top. To climb up and over I had to bounce on their big double bed like a trampoline and leap over to catch the lip of Dad's cupboard and then scramble over the edge just in time to be quiet and settled before Merydyth came looking for me. She looked under the beds, under the pillows behind the cupboards and in the fireplace, but she did not find me.

I did not want to give in too quickly so I settled down to wait for the rest of my siblings to find me.

It was quite soft up there and very dusty, with heaps of fluff that tickled my nose causing me to sneeze now and then. Every so often the others would hear and come to look but they still did not find me. I began to get bored and found that on top off the cupboards with me were three large tins of biscuits, two Sao biscuits tins and a bush biscuit tin. I opened them expecting to find a biscuit to eat but they were all filled with rolls and rolls of paper money. The money felt old and worn and I soon became bored and jumped down and came out calling that I was the queen of the best hiding spot. For my trouble I was put in the bath - last! by mum because "I was dirty and not to play in that place, where ever it was, again". I soon forgot about the biscuit tins of 'old' money.

As was the family tradition in those days we all sat down together at the dinner table to eat our meals. The one we liked best was the evening meal. Well I should say we either liked it best or hated it because we could all go from laughing with fun, joy or hysteria one moment to crying with sadness, fear or pain another. Our Dad was a great story teller and could have us laughing one minute or crying the next. When we were laughing the four of us would become so loudly out of control that it often took several warnings to behave and often a clip over the head for one of us before we'd quieten down. We loved listening to Dad's stories about when each of us were born. or of mum's adventures growing up on the mighty Murray river and Dad fighting battles in the schoolyard.

But tonight our parents were talking of a new move to another house and of the old lady who used to own the house which was now ours. Apparently the old lady had said that her husband had never used the bank to store their money, as banks were not to be trusted and also because of the depression. He had also wished to evade tax because he said the government took all your hard won money. Anyway, instead of putting his money in the bank, it was said that he had hidden the money in the house which was now our home. Mum and Dad were discussing where they had looked for it so far. Dad had dug up most of the garden and looked in the garage and laundry and up in the rafters. Mum had gone through the cellar and all the boxes stored there. Dad had promised to return the money to the old lady when he found her treasure but had run out of ideas as to where to look. I piped up "I know where the treasure is!" "Oh” said Dad, “And where is that?" "If I tell you daddy, then everyone will know and you will have to hide it all again" "Well you had better whisper it to me", says Dad and that is what I did. It was always nice whispering in Daddy's ear he smelt nice and soapy.

It was then time for bedtime stories and bed and I cannot remember thinking of the money in the biscuits tins until years later. I think this was

because money and money problems were not usually discussed with children. All I can ever remember my father talking about is that he had to keep earning money because his wife and children kept spending.

Much later, I was married and all our families were gathered together for Xmas at Mum and Dads. Sitting all squashed now around the dinner table laden with food I asked Dad what he did with the money in the biscuit boxes and he looked at me in surprise as he had forgotten I had told him where to find them. Dad proceeded to tell the story.

Dad and Mum had gone to sleep that night and from where they were lying in bed had looked up to the top of the cupboard in question and Dad says "Can you see boxes up there Daff?" "No I can't" says Mum, and snuggling together eventually they went to sleep. Dad was always up early and the next morning the first rays of sun was shining through the window and as Dad was getting out of bed he saw the light reflecting off something on top of the wardrobe and so he went and got a ladder and found the biscuit boxes full of money. But that was not all, because as he took the boxes away he noticed the areas under where the boxes were there were more rolls of money in some places three or four rolls deep and it went the whole way along the top of the wardrobe. The old boss had been carefully stacking money away for a rainy day for years and had never told his wife where he put it. Dad passed the boxes down to Mum who stacked them on the bed, then he started handing down the rolls of money lying on top of the wardrobe but hidden by the ornate carving. All in all the amount was well over 60,000 pounds in the rolls loosely tossed and pressed flat on top of the wardrobe, "we never counted the money in the boxes “said Dad. Dad and Mum carefully bundled it all up and gave every penny to the old lady as they had promised and would accept nothing as reward.

"But Dad surely she gave you a reward" we all cried. Mum and Dad looked at each other and Dad replied, “We had decided it all belonged to her and so we returned it all to her telling how one of our children had found the biscuit boxes and that we had found the rest.". I exclaimed, "Oh Dad, it must have been hard to give it all to her" He replied, "Not really. It was never earned by us, it didn't belong to us, and we had the rest of our lives to earn as much as we needed. When we moved into the house I had promised to return the money to the old lady if I ever found it!"

The little old lady lived well ever after.

Lisbethsusanne also contributed the following to tell of her father’s retirement years.

“NORMAN (Dad) had been retired for several years when, in 1982, he was asked by a good friend Vass Cronin (I Think), who worked with the Community Welfare Volunteers in Hindmarsh, if he, Dad, would help find work for young offenders for the Department of Community Welfare. Dad quickly realized the young boys had no work skills or understanding of work ethics. He set up a workshop in a shed located behind the Community Welfare Volunteers offices in Hindmarsh. This was a pre -work program which helped young offenders to learn metal working skills and also what was expected from a good worker. They would make letter boxes and wheelbarrows to sell.

Punctuality, skill in workmanship, effort and no slouching was harnessed through a firm friendly work environment. This was assisted by Daphne (his Wife) who when told by Norman that some boys did not arrive with lunch and worked all day without food, she would make up plates of sandwiches and bake cakes for Dad to take and share around at Smoko and Lunchtime.

He was so successful in finding permanent work for the boys that in 1986 he applied for and was granted $100,000.00 from State government and was able to expand the program, relocating from the office's back shed to a Garage in Hindmash. As he expanded he called on his old retired workers to come and assist with different aspects of teaching. The Program kept growing through two more premises until he moved to a factory site in Brompton. Which was the size of a large Target or Kmart.

This site came rent free as long as the council rates were paid, I unfortunately forget the name of who the actual owner was. Dad meanwhile was helping not only young offenders but, retraining men and women who had lost their previous employment and also taking on school leavers now in part now running a skillshare manufacturing factory Called the Hindmash Industrial Training Project. He would source work, which was needed in the community, such as bus shelters and bike racks for train-stations and play areas, fencing was another area.

Ian (her brother) said Dad was so good at seeing what was needed in setting up manufacturing companies he could have earnt quite a bit as a consultant. Although Norman now had funding for 4 paid members of staff, most of his helpmates were retired volunteers, many being from his own factory. Noman did not work for a salary in all this he received help with expenses incurred such as needed newspaper, petrol and travel allowances.

His program was so successful that from very early on Dad was visited several times by dignitaries from around the world Japan, Europe, Britain, Canada, and the USA.

He also saw that by teaching the youths how to make things that contributed to the community such as bike railings and bus shelters he could supplement

the program cutting the costs by more than half. But it also showed the boys they themselves were contributing to the community.

In 1992 Dad was awarded The Order Of Australia and in his acceptance speech he said nothing could have been achieved without the support of his lovely wife Daphne or the contribution and help of those of his workers, it was their cooperation and teamwork that brought the whole together. He continued to work on and off until five weeks before his death in 2000, of cancer."

Image 44: Norman Wright

Definitions

Background

Experiments in the design and selection of cargo containers were conducted in many countries and by many shippers. They were extensive, varied and conducted over a long time but failed to change the world until "pioneers" developed and tested systems that worked for them. Each pioneer demonstrated that great savings in the cost of transport could be realised using their methods.

The International Standards Organisation (ISO) was instructed by its members to study the methods designs and implementation systems employed by the "pioneers" and consolidate them into a set of practical standards acceptable to the world. It is not clear how they selected their "pioneers" but they, the pioneers, were all demonstrating their systems to the world together post WW2 and were easy to identify by an informed observer. There were only three.

On the East coast of America
Malcolm McLean- Pan Atlantic Steamship Company 1956

Coastal Australia
McIlwraith McEacharn Ltd 1957

On the West coast of America
Matson Navigation Co 1958

Definition 1

"A pioneer of intermodal containerisation is one who designed intermodal containers, invested in them and proved it possible and economically

advantageous for them to be carried by their own ships and transferred to road vehicles, aircraft and rail wagons. Later they all abandoned their own system and reinvested largely at their own expense to adopt the ISO containers when the relevant standards were approved."

The following definition given in the third edition of the Collins English dictionary published in 1991 is enlarged by this author to cover our special subject.

Definition 2

"An intermodal container is reusable and able to be carried by different modes of conveyance including ships, road vehicles, aircraft and rail wagons and transferred between them without being unpacked."

Our report on containerisation concentrates on key people and organisations and significant events that satisfy the two definitions above.